GFZ
Helmholtz Centre
POTSDAM

HELMHOLTZ CENTRE POTSDAM
GFZ GERMAN RESEARCH CENTRE
FOR GEOSCIENCES

Achim Brauer & Markus J. Schwab (eds.)

DEUQUA2022 Conference

Connecting Geoarchives

Abstract Volume

Scientific Technical Report STR22/02

Recommended citation of the publication

Brauer, A., Schwab, M. J. (Eds.)(2022): DEUQUA2022 Conference: Connecting Geoarchives; Abstract Volume, (Scientific Technical Report STR; 22/02), DEUQUA 2022 - Connecting Geoarchives (Potsdam 2022), Potsdam: GFZ German Research Centre for Geosciences.
https://doi.org/10.48440/GFZ.b103-22024

Imprint

Helmholtz Centre Potsdam
GFZ German Research Centre for Geosciences
Telegrafenberg
D-14473 Potsdam

Published in Potsdam, Germany
2022

DOI: https://doi.org/10.48440/gfz.b103-22024
URN: urn:nbn:de:kobv:b103-22024

This work is published in the GFZ series Scientific Technical Report STR and electronically available via our repository GFZpublic: https://tinyurl.com/GFZ-ST-Reports

DEUQUA2022 Conference

Connecting Geoarchives

Abstract Volume

Achim Brauer & Markus J. Schwab (eds.)

Scientific Technical Report STR - Data 22/02

Quelle: https://www.gfz-potsdam.de

DEUQUA 2022
25.-29.09.2022
GFZ Potsdam

DEUQUA 2022

“Connecting Geoarchives”

Abstract Volume

Edited by
Achim Brauer & Markus J. Schwab

25-29 September 2022, GFZ German Research Centre for Geosciences, Potsdam, Germany

Table of Contents

Vorwort

Wir heißen alle Freunde der Quartärgeologie in Potsdam auf dem Telegrafenberg, einem Relikt des maximalen Eisvorstoßes des Weichselglazials, herzlich willkommen. Nach genau 20 Jahren ist dies die zweite DEUQUA-Tagung, die in Potsdam stattfindet. In diesen 20 Jahren gab es bedeutende wissenschaftliche Fortschritte mit neuen analytischen Entwicklungen, Ideen und Forschungsfragen. Besonders der Schritt von der Untersuchung singulärer Standorte hin zu regionalen, hemisphärischen oder sogar globalen Rekonstruktionen der vergangenen Umwelt und Klimabedingungen spiegelt sich im Thema "Connecting Geoarchives" dieser Konferenz wider. Forensische Analysen vergangener Klimaveränderungen sind nach wie vor unerlässlich für eine bessere Bewertung insbesondere der Auswirkungen des zukünftigen Klimawandels auf die Umwelt, auch wenn die Ursachen des derzeitigen Klimawandels mit den rasch zunehmenden anthropogenen Treibhausgasemissionen andere sind als in der Vergangenheit. Vor diesem Hintergrund steht die Quartär- und Paläoklimaforschung vor neuen Herausforderungen, die auch im Mittelpunkt des öffentlichen Abendvortrags eines geladenen Gastredners stehen werden.

Die Entwicklung der Wissenschaft in den letzten 20 Jahren hat auch zu Veränderungen der DEUQUA selbst geführt, die internationaler geworden ist und viele Verbindungen zu Partnerorganisationen in aller Welt geknüpft hat. Diesem Umstand tragen wir Rechnung, indem wir internationale Experten als Hauptredner für unsere Sitzungen eingeladen haben, die uns neue Entwicklungen und Ideen in ihren Forschungsgebieten vorstellen. Aus diesem Grund wird die Konferenz weitgehend zweisprachig sein. Dies bedeutet jedoch nicht, dass wir unsere Wurzeln vergessen. Deshalb werden in einem Themenblock in deutscher Sprache neue Entwicklungen und Erkenntnisse der regionalen Quartärgeologie Deutschlands präsentiert.

Zunehmend von Bedeutung ist auch unsere Pflicht, die Gesellschaft über die interessanten und faszinierenden Ergebnisse unserer Forschung in einer Welt sich schnell verändernder Kommunikationsmittel umfassend zu informieren. Dafür haben wir Experten für Wissenschaftskommunikation eingeladen, die uns neue Entwicklungen auf diesem Gebiet vorstellen und mit uns diskutieren werden.

Wir danken Ihnen allen, dass Sie nach Potsdam gekommen sind und wünschen uns allen fruchtbare Diskussionen, neue Ideen und Kooperationen, einen spannenden Exkursionstag und eine schöne Zeit in Potsdam. Achten Sie auf Ihre eigene Gesundheit und die Ihrer Kollegen!

Achim Brauer und Markus Schwab

Preface

We cordially welcome all enthusiasts of Quaternary geology in Potsdam on the Telegrafenberg, a legacy of the last glacial maximum. After exactly 20 years, this is the second DEUQUA conference held in Potsdam. There has been much scientific progress in these 20 years with new analytical developments, ideas and research questions. This is reflected in the theme of the conference ‘*Connecting Geoarchives*’, reflecting the development from single site to regional, hemispheric or even global views and reconstructions of past environments and climate. Forensic analyses of past climate changes are still essential for an advanced assessment especially of future climate change impacts on the environment even if the driving factors are different than before due to rapidly increasing anthropogenic greenhouse gas emissions. In view of this, Quaternary and palaeoclimate research faces new challenges that will be in the focus of a public evening lecture by an invited guest speaker.

The development of science in the last 20 years also lead to changes of DEUQUA itself which became more international and established many connections to partner organizations around the world. We take this into account by inviting international experts as key note speakers for our sessions to present us new developments and ideas in their fields of research. As a matter of course, the conference will be largely bi-lingual. But this does not mean that we forget our roots and, therefore, have one session in German language with a special focus on new developments in regional Quaternary geology of Germany.

Last but not least, we have to serve the society with the interesting and exciting results of our research in a world of rapidly changing ways of communication. Therefore, we have invited experts in science communication who will show and discuss with us new developments in this field.

We thank all of you for coming to Potsdam and wish all of us fruitful discussions, new ideas and collaborations, an exciting day in the field and an enjoyable time in Potsdam. Take care for your own health and that of your colleagues!

Achim Brauer and Markus Schwab

Chapter I: Program Overview

Venue: GFZ German Research Centre for Geosciences
Address: Albert Einstein Science Park, Telegrafenberg Haus H, 14473 Potsdam (Germany)

	Sunday September 25, 2022
10:00 - 16:30	**Bicycle pre-conference excursion**
16:30 - 19:00	**Registration**
17:00 - 20:00	**Ice breaker**
	Monday September 26, 2022
08:30 - 09:00	**Registration**
09:00 - 09:30	**Opening / Welcome Notes** **Susanne Buiter (GFZ Scientific Executive Director & Spokesperson of Executive Board)** **Dirk Sachse (GFZ Director of Topic 5 "Future Landscapes")** **Frank Preusser (DEUQUA-President)**
09:30 - 12:30	**Session 1: *Climate variability and warmer climates*** **Convener: Claudia Wrozyna & Cécile Blanchet**
09:30 - 10:00	**KEYNOTE: Emilie Capron** (Université Grenoble, France) Insights into our future from past interglacials
10:00 - 10:20	**Christiane Richter** (TU Dresden) What Quaternary gastropods tell us about the effect of climate changes on Canary ecosystems
10:20 - 10:40	**Andreas Koutsodendris** (Heidelberg University) Climate and ecosystem variability in SE Europe since the Early Pleistocene: The Tenaghi Philippon archive revisited
10:40 - 11:00	**Vanessa Skiba** (PIK) On the forcing of glacial abrupt climate transitions of the last 300,000 years
11:00 - 11:30 **Coffee Break**	
11:30 - 11:50	**Peter Fischer** (University Mainz) Millennial to centennial scale terrestrial ecosystem responses to Upper Pleistocene North Atlantic climatic oscillations in Central Europe
11:50 - 12:10	**Johanna Lomax** (University Giessen) Late Glacial and Holocene environmental change recorded at the gravel pit Niederweimar (Central Hesse)
12:10 - 12:30	**Henning A. Bauch** (AWI & GEOMAR) Asymmetric development of sub-Arctic temperature regimes during interglacial MIS 11

12:30 - 15:20	**Session 4: *Anthropogenic activity recorded in geoarchives*** **Convener: Elisabeth Dietze & Julia Meister**
12:30 - 13:00	**KEYNOTE: Yoshi Maezumi** (MPI Jena) Reconstructing past land use and cultural burning in the Amazon
13:00 - 14:00 **Lunch break**	
14:00 - 14:20	**Hans von Suchodoletz** (University Leipzig) Holocene human-environmental interactions and seismic activity in a Late Bronze to Early Iron Age settlement center in the southeastern Caucasus
14:20 - 14:40	**Susanne Liebner** (GFZ) Human impact on cyanobacteria during the Holocene revealed by sedimentary DNA from Lake Tiefer See
14:40 - 15:00	**Antonia Reiß** (University Mainz) Between land reclamation and storm surges – man-environment interactions in the Trendermarsch (North Frisia, Germany)
15:00 - 15:20	**Sascha Krüger** (National Museum of Denmark, Lyngby) Fire, fungi and forage - tracing palaeolithic human-environmental interactions in sediments from the Nahe palaeolake (Schleswig-Holstein)
15:20 - 15:40 **Coffee Break**	
15:40 - 18:00	**Poster Session for Sessions 1 and 4** **with oral introduction**
18:00 - 19:00	Guided tour Telegrafenberg (in German and English)
19:15 - 20:15	**Evening lecture:** **Jörg Pross (Universität Heidelberg): Die Rolle der Paläoklimatologie in der aktuellen Klimadebatte: Potenziale und Herausforderungen**
	Tuesday September 27, 2022
08:30 - 10:00	**Session 2: *Abrupt climate change and extreme events*** **Convener: Claudia Wrozyna & Cécile Blanchet**
08:30 - 09:00	**KEYNOTE: *Monica Ionita-Scholz*** *(AWI Bremerhaven)* Response of the European hydroclimate to a slowdown of the Atlantic Meridional Overturning Circulation
09:00 - 09:20	**Christopher Berndt** (University Greifswald) Hurricane impacts on lake hydrogeochemistry as recorded by ostracod stable C and O isotopes in Lago Enriquillo, Dominican Republic
09:20 - 09:40	**Blaise Gravier** (University Leipzig & MPI Jena) Dust provenance analyses show changes in air-masses circulation over the North African desert margin during the Holocene
09:40 - 10:00	**Ido Sirota** (The Hebrew University of Jerusalem) A mechanistic approach for interpreting hydroclimate from halite-bearing sediments during abrupt climatic transitions

10:00 - 10:30 **Coffee Break**	
10:30 - 12:20	**Session 3: *Synchronization and dating of climate proxy records*** ***Convener: Achim Brauer & Daniela Müller***
10:30 - 11:00	**KEYNOTE: Siwan Davies** (Swansea University, UK) The cryptotephra revolution: connecting, correlating and constraining chronologies
11:00 - 11:20	**Rebecca Kearney** (GFZ) The TephroMed project: Using tephra to precisely synchronising two key palaeoclimatic ICDP records of the eastern Mediterranean region
11:20 - 11:40	**Markus Czymzik** (IOW) Synchronizing the Baltic Sea and Lake Kälksjön sediment records using the cosmogenic radionuclide ^{10}Be
11:40 - 12:00	**Daniel Wolf** (TU Dresden) Connecting loess archives in the Western and Eastern Mediterranean
12:00 - 12:20	**Nikolas Krauß** (University Greifswald) Geochronological investigations at the Last Glacial Maximum of the Scandinavian Ice Sheet in NE-Germany
12:30 - 15:20	**Session 5: *Earth surface processes and environmental change*** **Convener: Michael Dietze & Margret Fuchs**
12:30 - 13:00	**KEYNOTE: Sibylle Knapp** (TU München) Landslide hazards in a changing alpine environment – the key role of lakes
13:00 - 14:00 **Lunch Break**	
14:00 - 14:20	**Kathleen Stoof-Leichsenring** (AWI Potsdam) Potential of sedimentary ancient DNA in reconstructing past arctic ecosystems
14:20 - 14:40	**Mirosław Błaszkiewicz** (IGSO, Polish Academy of Sciences) Permafrost evolution in the last glacial period in the North-Central European Lowlands
14:40 - 15:00	**Christiaan Diemont** (University of Sheffield) Non-climatic drivers of ice marginal shifts arising from the interplay of regional ice dynamics: A discussion in relation to moraines of the Southern Sector Scandinavian Ice Sheet
15:00 - 15:20	**Fergus McNab** (GFZ) Responses of alluvial river networks to periodic environmental change: Linking stratigraphic and geomorphic archives
15:20 - 15:40 **Coffee Break**	
15:40 - 18:00	**Poster Session for Sessions 2, 3 and 5** **with oral introduction**
18:00 - 19:00	Junge DEUQUA Kick-off Meeting[1]
19:30	**Conference Dinner**

[1] We want to discuss the possibilities of establishing a group for young scientist in DEUQUA. We kindly invite all interested students, PhD students or young postdocs to join this meeting, as an opportunity to get to know each other and to exchange your ideas.

Wednesday September 28, 2022

08:30 - 10:10	**Session 6: *Regional Quaternary geology*** **Convener: Henrik Rother & Christian Hoselmann**
08:30 - 08:50	**Jaqueline Strahl** (LBGR Brandenburg) Die Karte der Holstein-zeitlichen Ablagerungen von Brandenburg 1 : 300 000
08:50 - 09:10	**Jürgen M. Reitner** (Geologische Bundesanstalt, Wien) Begriffskataloge der Geologischen Landesaufnahme für Quartär und Massenbewegungen in Österreich: Grundlage und Praxis
09:10 - 09:30	**Felix Martin Hofmann** (University Freiburg) Zeitpunkt des spätpleistozänen Vergletscherungsmaximums und Chronologie der Gletscherveränderungen am Ende der letzten Deglaziation des Südschwarzwaldes, Deutschland: vorläufige Ergebnisse
09:30 - 09:50	**Ulrike Wielandt-Schuster** (Regierungspräsidium Freiburg, Landesamt für Geologie, Rohstoffe und Bergbau) Die Sedimentabfolgen im Oberrheingraben: Litho- und Biostratigraphie in einer tektonisch aktiven Umgebung
09:50 - 10:10	**Philipp Stojakowits** (LBEG Niedersachsen) Ergebnisse pollenanalytischer Untersuchungen an saalespätglazialen bis weichselpleniglazialen Sedimenten aus dem Quakenbrücker Becken (Niedersachsen)
10:10 - 10:30 **Coffee Break**	
10:30 - 12:00	Award ceremony and DEUQUA meeting
12:00 - 13:00	**Poster Session for Session 6** **with oral introduction**
13:00 - 14:00 **Lunch break**	
14:00 - 15:00	**Poster Session for Session 6** **with oral introduction**
15:00 - 15:30 **Coffee Break**	
15:30 - 16:30	**Renate Treffeisen & Klaus Grosfeld** (AWI) From science to society – on the importance of knowledge transfer in modern science – examples of products and tools (Impulsvortrag und Diskussion)
16:30 - 16:45	**Closing remarks**
17:00 - 18:30	**Short course K1**: Overcoming challenges in publishing research data

Thursday September 29, 2022

08:30 - ca 19:00	**Post-conference bus excursions**
09:00 – ca 16:00	**Day course K2**: Advanced XRF data analyses using Xelerate

Chapter II: Abstracts - *Overview in alphabetical order*

Overview in alphabetical order		
45	**Diemont, Christiaan;** Clark, Chris; Livingstone, Stephen; Bradley, Sarah & Hughes, Anna: Non-climatic drivers of ice marginal shifts arising from the interplay of regional ice dynamics: A discussion in relation to moraines of the Southern Sector Scandinavian Ice Sheet	Oral
45	**Dietze, Elisabeth**; Andreev, A.; Mangelsdorf, K.; Reichel, V.; Tessendorf, T.; Weise, J.; Lisovski, S. & Herzschuh, U.: Towards quantitative fire-vegetation-climate feedbacks: linking sedimentary fire proxy composition of interglacial Lake El’gygytgyn with modern lake sediments	Poster
47	**Dietze, Michael**; Kreutzer, Sebastian; Fuchs, Margret C. & Meszner, Sascha: Going virtual: testing our proxy archive assumptions by creating and sampling virtual sediment sections with the R package 'sandbox'	Poster
48	**Dreibrodt, Stefan:** Earthworms, Darwin and prehistoric agriculture-Chernozem genesis reconsidered	Poster
49	**Firla, Gustav**; Lüthgens, Christopher; Schmalfuß, Clemens; Neuhuber, Stephanie & Fiebig, Markus: Revisiting the geochronology of a drill-core in the glacially overdeepened basin underneath Neusillerdorf, near Freilassing Bavaria using single grain feldspar luminescence dating	Poster
50	**Fischer, Peter;** Prud’homme, Charlotte; Jöris, Olaf; Hatté, Christine; Vinnepand, Mathias; Moine, Olivier; Fitzsimmons, Kathryn E. & Vött, Andreas: Millennial to centennial scale terrestrial ecosystem responses to Upper Pleistocene North Atlantic climatic oscillations in Central Europe	Oral
51	**Francis, Oliver;** Tang, Hui & Turowski, Jens: Sedimentary controls on runoff-generated debris flow frequency	Poster
52	**García, M. Luján**; Birlo, Stella & Zolitschka Bernd: Climatic and antrophogenic impacts recorded by diatoms from Holocene sediments of Holzmaar, Germany	Poster
54	**Gegg, Lukas**; Griebling, Felicitas; Jacob, Laura; Jentz, Nicole; Schwahn, Fiona; Stark, Lena; Wielandt-Schuster, Ulrike & Preusser, Frank: Einblicke in die Vergangenheit: neue pleistozäne Profile aus dem Oberrheingraben	Poster
55	**Geis, Anna-Lena**; Sontag-González, Mariana; Hoselmann, Christian & Fuchs, Markus: Anwendung der Infrarot-Radiofluoreszenz-Datierungsmethode (IR-RF) am Bohrkern von Riedstadt-Erfelden zur Erstellung einer Chronologie des nördlichen Oberrheingrabens	Poster
56	**Glückler, Ramesh**; Geng, Rongwei; Grimm, Lennart; Baisheva, Izabella; Herzschuh, Ulrike; Stoof-Leichsenring, Kathleen; Kruse, Stefan; Andreev, Andrei; Pestryakova, Luidmila & Dietze, Elisabeth: Holocene wildfire and vegetation dynamics in Central Yakutia, Siberia, reconstructed from lake-sediment proxies	Poster
58	**Gravier, Blaise;** Schmidt, Johannes; Kertscher, Cathleen; Schneider, Birgit; Dietze, Elisabeth; Benkaddour, Abdelfattah; Mikdad, Abdeslam; Bolland, Alexander; Fletcher, William; Mischke, Steffen; Galer, Stephen J.G.; Haug, Gerald; Zielhofer, Christoph & Pichat, Sylvain: Dust provenance analyses show changes in air-masses circulation over the North African desert margin during the Holocene	Oral
59	**Grimm, Bastian E. W. W.**; Grimm, Matthias C. & Streb, Alexander R.: Neue Einblicke in die Stratigraphie der periglazialen Deckschichten basierend auf geochemischen und geophysikalischen Untersuchungen im südlichen Rheinischen Schiefergebirge bei Waldalgesheim (Rheinland-Pfalz, SW-Deutschland)	Poster
60	**Grimm, Lennart**; Glückler, Ramesh; Herzschuh, Ulrike & Dietze, Elisabeth: Paleofire reconstructions from a thermokarst lake in Central Yakutia, Siberia	Poster

Overview in alphabetical order		
62	**Guillerm, Emmanuel**; Lowenstein, Tim K.; Gardien, Véronique; Caupin, Frédéric & Brauer, Achim: Unlocking temperatures and lake levels archived in Holocene Dead Sea halite fluid inclusions	Poster
62	**Haberzettl, Torsten**; Adolph, Marie-Luise; Troelstra, Veerle; Dreßler, Mirko; Wrozyna, Claudia & Lorenz, Sebastian: Subrecent Anthropogenic Impact on Sediments from Schweriner See	Poster
63	**Hebenstreit, Robert**; Hardt, Jacob & Böse, Margot: First evidence for an LGM glaciation in the Central Mountain Range, Taiwan - dated with terrestrial cosmogenic nuclides	Poster
65	**Höfer, Dana**; Stebich, Martina; Lauer, Tobias & Katzschmann, Lutz: Palynologische Untersuchungen zu Biostratigraphie und Paläoumwelt des Mittelpleistozäns in Thüringen	Poster
67	**Höhle, Marlene** & Wrozyna, Claudia: Spatio-temporal distribution of ostracod species in saline inland lakes (Mansfeld lake area; Central Germany)	Poster
68	**Hofmann, Felix Martin**; Schimmelpfennig, Irene; ASTER Team & Preusser, Frank: Zeitpunkt des spätpleistozänen Vergletscherungsmaximums und Chronologie der Gletscherver-änderungen am Ende der letzten Deglaziation des Südschwarzwaldes, Deutschland: vorläufige Ergebnisse	Oral
69	**Hoselmann, Christian**; Mair, Johannes & Wedel, Joachim: Die Forschungsbohrung Riedstadt-Erfelden und neue Ergebnisse zur Geologie des nördlichen Oberrheingrabens	Poster
71	**Ionita-Scholz, Monica:** Response of the European hydroclimate to a slowdown of the Atlantic Meridional Overturning Circulation	Keynote
71	**Juschus, Olaf**; Probst, Robert; Frömberg, Pia & Strahl, Jaqueline: From meandering riverbeds to an artificial channel – Late Pleistocene and Holocene development of River Welse (NE Brandenburg)	Poster
72	**Juśkiewicz, Włodzimierz &** Pydyn, Andrzej: Tracing the impact of settlements on landscape transformations during the last 1200 years of Greater Poland recorded in the Lednica Lake sediments – based on the multiproxy approach	Poster
74	**Kamleitner, Sarah**; Ivy-Ochs, Susan; Salcher, Bernhard & Reitner, Jürgen M.: Ice flow pattern of the late LGM Rhine glacier, northern Alpine foreland, reconstructed from a new inventory of streamlined subglacial bedforms	Poster
75	Kaufmann, Uwe; **Wielandt-Schuster, Ulrike** & Hahne, Jürgen: Ein Fenster in den Sumpfzypressenwald von Rastatt	Poster
76	**Kearney, Rebecca;** Schwab, Markus J.; Neugebauer, Ina; Appelt, Oona; Pickarski, Nadine & Brauer, Achim: The TephroMed project: Using tephra to precisely synchronising two key palaeoclimatic ICDP records of the eastern Mediterranean region	Oral
77	**Kehl, Martin;** Seeger, Katharina; Pötter, Stephan; Schulte, Philipp; Klasen, Nicole; Zickel, Mirijam; Pastoors, Andreas & Claßen, Erich: Loess formation and chronology at the Palaeolithic key site Rheindahlen, Lower Rhine Embayment, Germany	Poster
78	Kern, Oliver A.; **Koutsodendris, Andreas**; Allstädt, Frederik; Mächtle, Bertil & Pross, Jörg: A centennial-scale-resolution record of climate and ecosystem variability in Central Europe during the past 130 kyrs from Füramoos, southern Germany	Poster

Overview in alphabetical order		
79	**Kertscher, Cathleen;** Schmidt, Johannes; Schneider, Birgit; Köhler, Anne; Dietze, Elisabeth; Benkkadour, Abdelfattah; Mikdad, Abdeslam; Werther, Lukas; Bolland, Alexander; Pichat, Sylvain; Fletcher, William; Mischke, Steffen & Zielhofer, Christoph: Sub-decadal scale environmental responses to hydro-climatic changes in the Middle Atlas Mountains, Morocco – learning from historical sources and a high-resolution multi-proxy lake sediment record	Poster
80	**Kleber, Arno** & Richter-Krautz, Jana: Fake Science vs. Science beim Klimawandel: Die paläoklimatologische Sicht	Poster
82	**Klinger, Aileen;** Endtmann, Elisabeth; Frenzel, Peter; Jöris, Olaf; Lauer, Tobias; Rappsilber, Ivo; Rother, Henrik; Vött, Andreas; Wansa, Stefan; Wollmeiner, Jana & Fischer, Peter: Multi-Proxy analyses and luminescence dating of Pleistocene deposits of former Lake Aschersleben (Saxony-Anhalt, Germany)	Poster
83	**Knapp, Sibylle:** Landslide hazards in a changing alpine environment – the key role of lakes	Keynote
84	**Kögler, Laura**; Wolf, Daniel; Kolb, Thomas; Faust, Dominik & Fuchs, Markus: Chronology of river terrace formation in the Baza/Guadix Basin, Spain	Poster
85	**Köhler, Anne**; Bauch, Martin; Schneider, Birgit; Berg, Stefanie; Werban, Ulrike; Pohle Marco & Zielhofer, Christoph: Extreme flood events and pre-modern flood-protection – The St. Mary Magdalene´s flood of 1342 and the subsequent straightening of the Danube near Straubing, Lower Bavaria	Poster
86	**Koutsodendris, Andreas** & Pross, Jörg: Climate and ecosystem variability in SE Europe since the Early Pleistocene: The Tenaghi Philippon archive revisited	Oral
87	**Krahn, Kim J.**; Haas, Kristin; Lemmes, Claudia; Saeidi Ghavi Andam, Sara; Gigl, Florian; Hinderer, Matthias; Hirbodian, Sigrid; Hollert, Henner; Marinova, Elena; Nelle, Oliver; Rösch, Manfred; Rückert, Peter; Plessen, Birgit; Tjallingii, Rik; Wick, Lucia & Schwalb, Antje: Multi-archive reseach for intertwined environmental and historic reconstruction of Bad Waldsee since medieval times	Poster
89	**Krauß, Nikolas**; Kenzler, Michael; Lüthgens, Christopher & Börner, Andreas: Geochronological investigations at the Last Glacial Maximum of the Scandinavian Ice Sheet in NE-Germany	Oral
90	**Krüger, Sascha;** Dörfler, Walter & Eriksen, Berit V.: Fire, fungi and forage - tracing palaeolithic human-environmental interactions in sediments from the Nahe palaeolake (Schleswig-Holstein)	Oral
91	**Krüger, Sascha;** Schnetger, B.; Strunk, A. & Jessen, C.: Charcoal or Biotite – the importance of minerals in the preparation and interpretation of Greenlandic palynological samples	Poster
92	**Labahn, Jakob**; Roettig, Christopher-B.; Kolb, Thomas; Pint, Anna; Marburg, Carsten; Menéndez, Inmaculada; Zech, Michael & Faust, Dominik: Quaternary vega sediments and dune archives on the Eastern Canary Islands	Poster
93	**Lomax, Johanna**; Sauer, Daniela; Shumilovskikh, Lyudmila; Hoselmann, Christian & Fuchs, Markus: Late Glacial and Holocene environmental change recorded at the gravel pit Niederweimar (Central Hesse)	Oral
94	**Lorenz, Melanie**; Elger, Kirsten; Achterberg, Inke; Semmler, Malte; Meistring, Marcel & Pfurr, Norbert: The Specialised Information Service for Geosciences (FID GEO): Supporting Open Access Publications for the Geosciences Community in Germany	Poster

Overview in alphabetical order		
94	**Maezumi, Yoshi:** Reconstructing past land use and cultural burning in the Amazon	Keynote
95	**Marik, Madhurima**; Hofmann, Felix Martin; Fülling, Alexander; Heydari, Maryam; Mueller, Daniela & Preusser, Frank: Luminescence Dating of Rock Surfaces and Large Clast: A New Approach Towards Reconstructing Quaternary Climate and Sediment Dynamics	Poster
97	**McNab, Fergus**; Schildgen, Taylor; Turowski, Jens & Wickert, Andrew: Responses of alluvial river networks to periodic environmental change: Linking stratigraphic and geomorphic archives	Oral
98	**Mingram, Jens:** Old sediments in new light - "unusual" light microscopic methods for the study of varved lake sediments	Poster
99	**Mohammednoor, Mosab**; Bussert, Robert; Tsukamoto, Sumiko; Bedri, Omer; Kraatz, Brian; Müller, Johannes; Salih, Khalafallah; Struck, Ulrich; Eisawi, Ali & Bibi, Faysal: Paleoclimate reconstruction using middle to late Pleistocene alluvial paleosols of the middle Atbara River in Eastern Sudan	Poster
100	**Müller, Daniela**; Neugebauer, Ina; Kearney, Rebecca; Schwab, Markus J.; Appelt, Oona; Czymzik, Markus; Kaiser, Jérôme; Arz, Helge W. & Brauer, Achim: Small but mighty – Synchronization of sediment records in the Baltic realm using cryptotephra	Poster
101	**Nagavciuc, Viorica**; Roibu, Catalin-Constantin; Mursa Andrei; Stirbu, Marian; Popa, Ionel & Ionita, Monica: A tree-ring reconstruction of streamflow variability over the last ~250 years in the Lower Danube	Poster
102	**Nuss, Margarita;** Fülling, Alexander; Sprafke, Tobias & Preusser, Frank: Detailed investigation of the unconformity in the lower part of the loess profile Bahlingen-Schönenberg	Poster
103	Nwosu, Ebuka Canisius; Brauer, Achim; Monchamp, Marie-Eve; Pinkerneil, Sylvia; Bartholomäus, Alexander; Theuerkauf, Martin; Stoof-Leichsenring, Kathleen R.; Wietelmann, Theresa; Kaiser, Jerome & **Liebner, Susanne:** Human impact on cyanobacteria during the Holocene revealed by sedimentary DNA from Lake Tiefer See	Oral
104	**Plessen, Birgit;** Pinkerneil, Sylvia; Brademann, Brian; Köppl, Matthias; Schwab, Markus J. & Brauer, Achim: Tracking environmental changes at lake Tiefer See/NE-Germany – from monitoring to the sedimentary record	Poster
105	**Pollhammer, Thomas**; Salcher, Bernhard; Kober, Florian & Deplazes, Gaudenz: Unravelling stratigraphic, glacio- and geodynamic information from glaciofluvial terrace hypsometry, North Alpine Foreland	Poster
106	**Prochnow, Maximilian**; Bliedtner, Marcel; Strobel, Paul; Struck, Julian; Bittner, Lucas; Schneider, Heike; Zech, Michael & Zech, Roland: Paleohydrological evolution during the Late Glacial based on compound-specific δ^2H and $\delta^{18}O$ analyses from Lake Bichlersee (Bavarian Alps)	Poster
107	**Rahimzadeh, Neda**; Sprafke, Tobias; Thiel, Christine; Terhorst, Birgit & Frechen, Manfred: Optical dating of Franconian loess, southern Germany: A comparison of polymineral and K-feldspar post-IR IRSL signals	Poster

Overview in alphabetical order		
109	**Reiß, Antonia;** Hadler, Hanna; Wilken, Dennis; Blankenfeldt, Ruth; von Carnap-Bornheim, Claus; Ickerodt, Ulf; Klooß, Stefanie; Majchczack, Bente; Rabbel, Wolfgang; Willershäuser, Timo & Vött, Andreas: Between land reclamation and storm surges – man-environment interactions in the Trendermarsch (North Frisia, Germany)	Oral
110	**Reiss, Lilian**; Stüwe, Christian; Einwögerer, Thomas; Händel, Marc; Maier, Andreas; Meng, Stefan; Pasda, Kerstin; Simon, Ulrich; Zolitschka, Bernd & Mayr, Christoph: Geochemical proxies and radiocarbon data from a loess record of the Upper Palaeolithic site Kammern-Grubgraben, Lower Austria	Poster
112	**Reitner, Jürgen M.**; Ivy-Ochs, Susan; Steinemann, Olivia; Lattner, Daniela & Römer, Alexander: The early Holocene Buchwiese rock avalanche (Eastern Alps, Austria): geological conditions, kinematics, morphological and sedimentary legacy	Poster
113	**Reitner, Jürgen M.**; Steinbichler, Mathias; Lotter, Michael & Steinbichler, Andrea: Begriffskataloge der Geologischen Landesaufnahme für Quartär und Massenbewegungen in Österreich: Grundlage und Praxis	Oral
114	**Richter, Christiane;** Roettig, Christopher-Bastian; Wolf, Daniel; Groh, Klaus; Kolb, Thomas & Faust, Dominik: What Quaternary gastropods tell us about the effect of climate changes on Canary ecosystems	Oral
116	**Ringleb, Bastian** & Fuchs, Markus: Modelling sediment dynamics in a mesoscale catchment of the Northern Franconian Jura, Germany	Poster
116	**Salcher, Bernhard**; Neuhuber, Stephanie; Otto, Jan-Christoph; Payer, Tom; Lüthgens, Christopher; Grupe, Sabine; Flores-Orozco, Adrian; Nørgaard, Jesper; Knudsen, Mads Faurschou & Fiebig, Markus: Terrace formation in response to climate, regional uplift and local normal faulting recorded in the Danube terrace staircase of Vienna	Poster
117	Sauer, Daniela; **Pfaffner, Nora**; Kadereit, Annette; Kreutzer, Sebastian; Wang, Tianhao; Karius, Volker; Kolb, Thomas; Bertran, Pascal; Bosq, Mathieu & Hatté, Christine: The loess section of Baix (Rhône Rift Valley, SE-France): a unique paleoenvironmental record from the transition between the temperate and the Mediterranean region of Europe	Poster
118	**Schmidt, Johannes**; Schmidt-Funke, Julia & Hardt, Matthias: Leipzig, city in a state of flux. Urban-fluvial symbiosis in a long-term perspective	Poster
120	**Sinapius, Ralf:** The importance of loess stratigraphy for soil geography in Saxony	Poster
121	**Sirota, Ido;** Armon, Moshe; Ben Dor, Yoav; Morin, Efrat; Lensky, Nadav G. & Enzel, Yehouda: A mechanistic approach for interpreting hydroclimate from halite-bearing sediments during abrupt climatic transitions	Oral
122	**Sitko, Katarzyna**; Kondracka, Marta; Wistuba, Małgorzata & Malik, Ireneusz: Record of soil creep on a forested mountain slope using dendrochronological and ERT methods – an example from the Outer Western Carpathians (southern Poland)	Poster
123	**Skiba, Vanessa**; Trüssel, Martin; Plessen, Birgit; Spötl, Christoph; Tjallingii, Rik; Eichstädter, René; Schröder-Ritzrau, Andrea; Braun, Tobias; Mitsui, Takahito; Frank, Norbert; Boers, Niklas; Zhang, Xu; Marwan, Norbert & Fohlmeister, Jens: On the forcing of glacial abrupt climate transitions of the last 300,000 years	Oral

Overview in alphabetical order		
124	**Słowiński, Michał**; Brauer, Achim; Nitychoruk, Jerzy; Czymzik, Markus; Sachse, Dirk; Lauterbach, Stefan, Tjallingii, Rik; Mroczkowska, Agnieszka; Polkowski, Tomasz; Theuerkauf, Martin; Łuców, Dominika; Halaś, Agnieszka; Błaszkiewicz, Mirosław; Szewczyk, Krzysztof; Czajkowska, Monika; Milena Obremska & Koutsodendris, Andreas: Novel multi-proxy approaches for synchronization of European palaeoclimate records from the Holstein interglacial - project concept	Poster
126	**Starke, Joris**; Bauriegel, Albrecht; Hardt, Jacob; Kirsten, Fabian, Lüthgens, Christopher & Sinapius, Ralf: Age, composition and genesis of sandy loess deposits (Sandlöss) in the Hoher Fläming (south-west Brandenburg, Germany) – first results	Poster
128	**Steiner, Martin;** Rambeau, Claire; May, Jan-Hendrik; Marx, Samuel; Vogel, Hendrik; Wolters, Steffen; Hille, Aaron & Preusser, Frank: Holocene dust evolution, drought, and fire history at Wildseemoor, northern Black Forest	Poster
130	**Stieg, Amelie**; Biskaborn, Boris K.; Herzschuh, Ulrike; Airo, Alessandro & Meyer, Hanno: Reconstructing hydroclimate extreme events using a high-resolution $\delta^{18}O_{diatom}$ record of Lake Khamra, Siberia	Poster
131	**Stojakowits, Philipp:** Ergebnisse pollenanalytischer Untersuchungen an saalespätglazialen bis weichselpleniglazialen Sedimenten aus dem Quakenbrücker Becken (Niedersachsen)	Oral
132	**Stojakowits, Philipp**; Preusser, Frank; Mayr, Christoph; Peters, Michael & Friedmann, Arne: Ein mittelwürmzeitliches Pollenprofil aus der Erdinger Altmoränenlandschaft (Oberbayern)	Poster
133	**Stoof-Leichsenring, Kathleen R.** & Herzschuh, Ulrike: Potential of sedimentary ancient DNA in reconstructing past arctic ecosystems	Oral
134	**Strahl, Jaqueline** & Sonntag, Angela: Die Karte der Holstein-zeitlichen Ablagerungen von Brandenburg 1 : 300 000	Oral
135	**Strahl, Jaqueline** & Sonntag, Angela: Zu den Ablagerungen der Dömnitz-Warmzeit im Typusgebiet Prignitz, NW-Brandenburg	Poster
137	**Thiel, Christine**; Hobiger, Manuel; Beiers, Sandra; Goebel, Björn & Spies, Thomas: Passive seismische Messungen zur Untersuchung der Quartärmächtigkeiten am Beispiel der Weserterrassen bei Hameln (Niedersachsen)	Poster
138	**Thiel, Christine**; Stephan, Hans-Jürgen; Kenzler, Michael; Frechen, Manfred & Grube, Alf: Geochronologische Untersuchungen der Eisrandlagen in Schleswig-Holstein	Poster
139	**Treffeisen, Renate & Grosfeld, Klaus:** From science to society – on the importance of knowledge transfer in modern science – examples of products and tools	Oral
140	**Urban, Anaïs**; Blanchet, Cecile; Brauer, Achim; Plessen, Birgit; Schwab, Markus J.; Tjallingii, Rik & Ziegler, Martin: Past temperatures of the Dead Sea during the last deglaciation- Insights from clumped isotope thermometry on authigenic carbonates	Poster
141	**Vinnepand, Mathias;** Zeeden, Christian; Noren, Anders; Asante, Thomas; Kaboth-Bahr, Stefanie; Gosling, William; Kück, Jochem & Wonik, Thomas: Assessing the temperature dependent magnetic susceptibility as a proxy in the depositional context of Lake Bosumtwi (Ghana) by using multivariate statistics	Poster

Overview in alphabetical order		
141	**von Suchodoletz, Hans;** Kirkitadze, Giorgi; Koff, Tiiu; Fischer, Markus L.; Poch, Rosa M.; Khosravichenar, Azra; Schneider, Birgit; Glaser, Bruno; Lindauer, Susanne; Navrozashvili, Levan; Lobjanidze, Mikheil; Akhalaia, Mate; Losaberidze; Levan & Elashvili; Mikheil: Holocene human-environmental interactions and seismic activity in a Late Bronze to Early Iron Age settlement center in the southeastern Caucasus	Oral
143	**Wansa, Stefan;** Strahl, Jaqueline & Meng, Stefan: Die Forschungsbohrung Martinsrieth – ein neues Profil für das jüngere Mittel- und das Oberpleistozän in der Helme-Niederung bei Sangerhausen (Sachsen-Anhalt)	Poster
145	**Wielandt-Schuster, Ulrike**; Stark, Lena & Hahne, Jürgen: Die Sedimentabfolgen im Oberrheingraben: Litho- und Biostratigraphie in einer tektonisch aktiven Umgebung	Oral
147	**Winkler, Stefan:** Potential for palaeoclimatic interpretation of periglacial landforms applying Schmidt-hammer exposure-age dating (SHD), examples from Norway and New Zealand	Poster
149	**Wolf, Daniel**; Kolb, Thomas; Lomax, Johanna; Zöller, Ludwig; Fuchs, Markus & Faust, Dominik: Connecting loess archives in the Western and Eastern Mediterranean	Oral
150	**Wolter, Juliane**; Bergstedt, Helena; Farquharson, Louise; Jones, Benjamin; Kanevskyi, Mikhail; Roy-Leveillee, Pascale; Veremeeva, Alexandra & Grosse, Guido: First results of regional-scale assessments of Holocene lake drainage ages in Arctic permafrost regions	Poster
151	**Wrozyna, Claudia**; Mischke, Steffen; Höhle, Marlene; Gross, Martin & Piller, Werner E.: Size matters: geographical variability of valve size of *Cyprideis torosa* and its taxonomic and ecologic implications	Poster
153	**Zielhofer, Christoph**; Schmidt, Johannes; Reiche, Niklas; Tautenhahn, Marie; Ballasus, Helen; Burkart, Michael; Linstädter, Anja; Dietze, Elisabeth; Kaiser, Knut & Mehler, Natascha: The Lower Havel River Region (Brandenburg, Germany): A 230-Year-Long Historical Map Record Indicates a Decrease in Surface Water Areas and Groundwater Levels	Poster

Abstracts - *Overview in thematic order*

Session 1: Climate variability and warmer climates

Session 2: Abrupt Climate Change and Extreme Events

58	**Gravier, Blaise;** Schmidt, Johannes; Kertscher, Cathleen; Schneider, Birgit; Dietze, Elisabeth; Benkaddour, Abdelfattah; Mikdad, Abdeslam; Bolland, Alexander; Fletcher, William; Mischke, Steffen; Galer, Stephen J.G.; Haug, Gerald; Zielhofer, Christoph & Pichat, Sylvain: Dust provenance analyses show changes in air-masses circulation over the North African desert margin during the Holocene	Oral
79	**Kertscher, Cathleen;** Schmidt, Johannes; Schneider, Birgit; Köhler, Anne; Dietze, Elisabeth; Benkkadour, Abdelfattah; Mikdad, Abdeslam; Werther, Lukas; Bolland, Alexander; Pichat, Sylvain; Fletcher, William; Mischke, Steffen & Zielhofer, Christoph: Sub-decadal scale environmental responses to hydro-climatic changes in the Middle Atlas Mountains, Morocco – learning from historical sources and a high-resolution multi-proxy lake sediment record	Poster
85	**Koehler, Anne**; Bauch, Martin; Schneider, Birgit; Berg, Stefanie; Werban, Ulrike; Pohle Marco & Zielhofer, Christoph: Extreme flood events and pre-modern flood-protection – The St. Mary Magdalene´s flood of 1342 and the subsequent straightening of the Danube near Straubing, Lower Bavaria	Poster
121	**Sirota, Ido;** Armon, Moshe; Ben Dor, Yoav; Morin, Efrat; Lensky, Nadav G. & Enzel, Yehouda: A mechanistic approach for interpreting hydroclimate from halite-bearing sediments during abrupt climatic transitions	Oral
130	**Stieg, Amelie**; Biskaborn, Boris K.; Herzschuh, Ulrike; Airo, Alessandro & Meyer, Hanno: Reconstructing hydroclimate extreme events using a high-resolution $\delta^{18}O_{diatom}$ record of Lake Khamra, Siberia	Poster

Session 3: Synchronisation and Dating of Proxy Records

Page		
44	**Davies, Siwan M.:** The cryptotephra revolution: connecting, correlating and constraining chronologies	Keynote
43	**Czymzik, Markus;** Brauer, Achim; Kaiser, Jérôme; Christl, Marcus; Schwab, Markus J. & Arz, Helge W.: Synchronizing the Baltic Sea and Lake Kälksjön sediment records using the cosmogenic radionuclide ^{10}Be	Oral
47	**Dietze, Michael**; Kreutzer, Sebastian; Fuchs, Margret C. & Meszner, Sascha: Going virtual: testing our proxy archive assumptions by creating and sampling virtual sediment sections with the R package 'sandbox'	Poster
49	**Firla, Gustav**; Lüthgens, Christopher; Schmalfuß, Clemens; Neuhuber, Stephanie & Fiebig, Markus: Revisiting the geochronology of a drill-core in the glacially overdeepened basin underneath Neusillerdorf, near Freilassing Bavaria using single grain feldspar luminescence dating	Poster
63	**Hebenstreit, Robert**; Hardt, Jacob & Böse, Margot: First evidence for an LGM glaciation in the Central Mountain Range, Taiwan - dated with terrestrial cosmogenic nuclides	Poster
76	**Kearney, Rebecca;** Schwab, Markus J.; Neugebauer, Ina; Appelt, Oona; Pickarski, Nadine & Brauer, Achim: The TephroMed project: Using tephra to precisely synchronising two key palaeoclimatic ICDP records of the eastern Mediterranean region	Oral

Page		
77	**Kehl, Martin;** Seeger, Katharina; Pötter, Stephan; Schulte, Philipp; Klasen, Nicole; Zickel, Mirijam; Pastoors, Andreas & Claßen, Erich: Loess formation and chronology at the Palaeolithic key site Rheindahlen, Lower Rhine Embayment, Germany	Poster
89	**Krauß, Nikolas**; Kenzler, Michael; Lüthgens, Christopher & Börner, Andreas: Geochronological investigations at the Last Glacial Maximum of the Scandinavian Ice Sheet in NE-Germany	Oral
95	**Marik, Madhurima**; Hofmann, Felix Martin; Fülling, Alexander; Heydari, Maryam; Mueller, Daniela & Preusser, Frank: Luminescence Dating of Rock Surfaces and Large Clast: A New Approach Towards Reconstructing Quaternary Climate and Sediment Dynamics	Poster
98	**Mingram, Jens:** Old sediments in new light - "unusual" light microscopic methods for the study of varved lake sediments	Poster
100	**Müller, Daniela**; Neugebauer, Ina; Kearney, Rebecca; Schwab, Markus J.; Appelt, Oona; Czymzik, Markus; Kaiser, Jérôme; Arz, Helge W. & Brauer, Achim: Small but mighty – Synchronization of sediment records in the Baltic realm using cryptotephra	Poster
101	**Nagavciuc, Viorica**; Roibu, Catalin-Constantin; Mursa Andrei; Stirbu, Marian; Popa, Ionel & Ionita, Monica: A tree-ring reconstruction of streamflow variability over the last ~250 years in the Lower Danube	Poster
107	**Rahimzadeh, Neda**; Sprafke, Tobias; Thiel, Christine; Terhorst, Birgit & Frechen, Manfred: Optical dating of Franconian loess, southern Germany: A comparison of polymineral and K-feldspar post-IR IRSL signals	Poster
124	**Słowiński, Michał**; Brauer, Achim; Nitychoruk, Jerzy; Czymzik, Markus; Sachse, Dirk; Lauterbach, Stefan, Tjallingii, Rik; Mroczkowska, Agnieszka; Polkowski, Tomasz; Theuerkauf, Martin; Łuców, Dominika; Halaś, Agnieszka; Błaszkiewicz, Mirosław; Szewczyk, Krzysztof; Czajkowska, Monika; Milena Obremska & Koutsodendris, Andreas: Novel multi-proxy approaches for synchronization of European palaeoclimate records from the Holstein interglacial - project concept	Poster
149	**Wolf, Daniel**; Kolb, Thomas; Lomax, Johanna; Zöller, Ludwig; Fuchs, Markus & Faust, Dominik: Connecting loess archives in the Western and Eastern Mediterranean	Oral

Session 4: Anthropogenic Activity Recorded in Geoarchives

Page		
94	**Maezumi, Yoshi:** Reconstructing past land use and cultural burning in the Amazon	Keynote
35	**Biskaborn, Boris K.;** Schnitt, Adrian; Rothe, Udo; Barsch, Jenny; Meyer, Hanno; Stoof-Leichsenring, Kathleen; Herzschuh, Ulrike; Kahl, Jan & Diekmann, Bernhard: Environmental and sedimentary responses of Groß-Glienicker See (Brandenburg-Berlin) to natural and anthropogenic forcings since the Last Glacial Maximum	Poster

Session 6: Regional Quaternary geology

Abstracts

In alphabetical order

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Die neue Internationale Quartärkarte von Europa im Aufbau: Zusammenarbeit ohne politische Grenzen

Asch, Kristine*

Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover, Deutschland
* Kontakt: Kristine.Asch@bgr.de

Das Projekt der Internationalen Quartärkarte von Europa und angrenzenden Gebieten im Maßstab 1 : 2,5 Millionen (International Quaternary Map of Europe and Adjacent Areas, IQUAME 2500) wird von der Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) koordiniert und umgesetzt. Es steht unter der Schirmherrschaft sowohl der International Union for Quaternary Science (INQUA) wie auch der Subkommission Europa der Commission for the Geological Map of the World (CGMW). Das Vorgänger-projekt wurde als Papierkartenserie kreiert (BGR & UNESCO 1967-1995). An diesem europäischen Kooperationsprojekt sind bislang geologische Organisationen aus 43 Ländern wie auch eine wissen-schaftliche Beratergruppe aus dem In- und Ausland beteiligt. Ziel des Projekts ist die Entwicklung eines webfähigen paneuropäischen Geo-Informationssystems (GIS) mit aktuellen wie auch harmonisierten Kartendatensätzen des europäischen Quartärs on-shore und off-shore. Die Kartendaten sollen später über das Geoportal der BGR digital zugänglich gemacht werden.

Im Projekt der IQUAME 2500 werden u.a. folgende Informationen und Daten kompiliert und gezeigt: Stratigraphie, Gesteinsart und Genese des europäischen Quartärs, maximale Ausdehnung zumindest der letzten Vereisung (u.a. aus Ehlers & Gibbard 2004) und deren Bewegungsrichtung (u.a. aus Hughes et al. 2015), glaziogenetische Einheiten, postglazialer Rückprall des Baltischen Schilds (s. Ågren & Svensson 2007), aktive Störungen sowie Lokationen von geologischem und archäologischem Interesse (z.B. Profile, ur- und frühgeschichtliche Fundorte).

Die Geologie kennt keine politischen Grenzen. Daher ist es eine besondere Herausforderung bei internationalen Projekten wie diesem, nicht nur die neuesten regionalen Quartär-Daten zu akquirieren und zu recherchieren, sondern diese vor allem digital zusammenzuführen und grenzübergreifend zu harmonisieren. Als Grundlage dafür dienen einheitliche Grundlagen, wie einheitliche topographische Basisdaten, Standard-Begriffslisten („controlled vocabularies“) und Richtlinien zur Beitragserstellung. Alle Daten müssen grenzüberschreitend schlüssig beschrieben werden, werden in Zusammenarbeit mit den beteiligten Experten semantisch und geometrisch harmonisiert und schließlich als (digitale) Kartenlayer strukturiert und harmonisiert dargestellt. So soll schließlich ein einheitliches Bild der Quartärgeologie Europas nach den neuesten Forschungs- und Kartierungsergebnissen entstehen. Dieser Beitrag wird auf den Hintergrund des Projektes sowie auf regionale Herausforderungen in Beispielen eingehen und die aktuellen Ergebnisse des Projektes vorstellen (s. Abb.1 und 2), die auf der „grenzenlosen“ guten Zusammenarbeit und den Beiträgen der Partnerinstitutionen und der wissenschaftlichen Berater beruhen.

Literatur

Ågren, J. & Svensson, R. (2007): Postglacial Land Uplift Model and System Definition for the New Swedish Height System RH 2000. Lantmäteriet (Gävle, Sweden)

BGR & UNESCO (1967-1995): International Quaternary Map of Europe, scale 1:2 500 000. 14 sheets. BGR (Hannover)

Ehlers ,J. & P.L. Gibbard, P.L. (Eds.) (2004): Quaternary Glaciations—Extent and Chronology. Elsevier, Amsterdam

Hughes, A., Gyllencreutz, R., Lohne, Ø., Mangerud, J. & Svendsen, J. (2015): The last Eurasian ice sheets – a chronological database and time-slice reconstruction, DATED-1. Boreas. 45. https://doi.org/10.1111/bor.12142

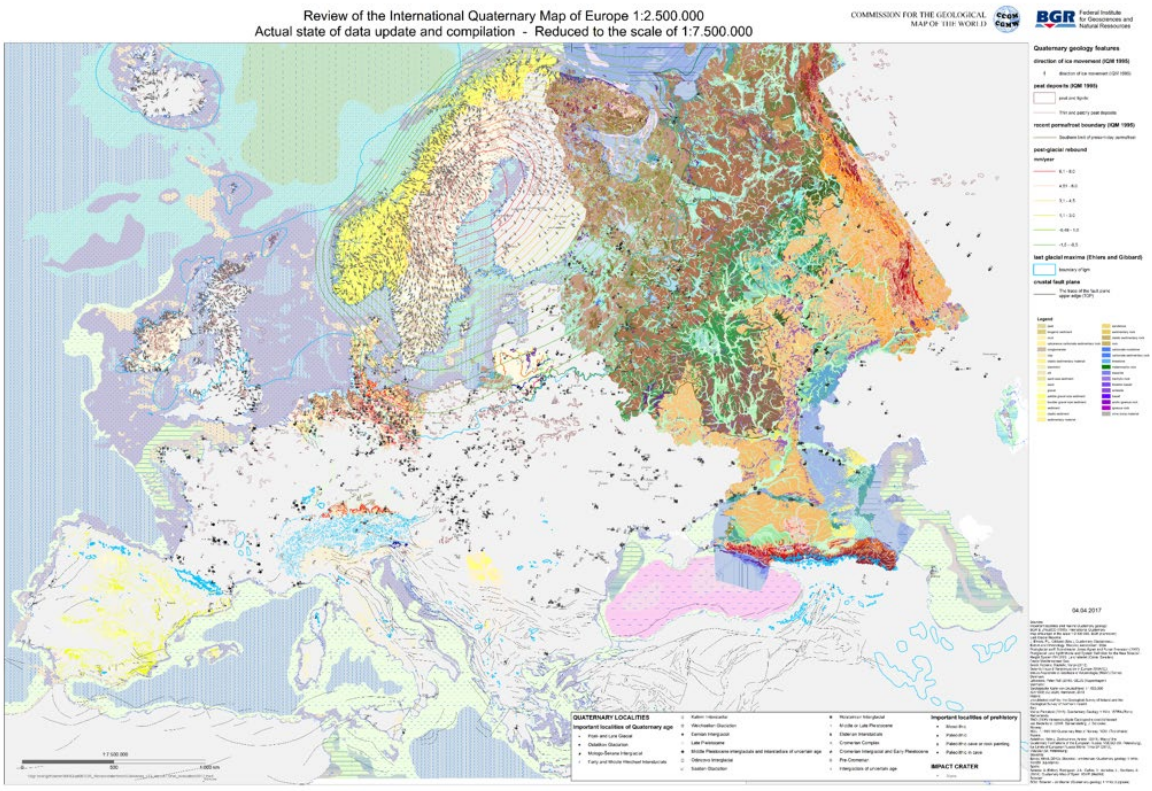

***Abb. 1**: Aktueller Status Juni der Kompilation der Internationalen Quartärkarte von Europa (IQUAME 2500). Stand: Juni 2022.*

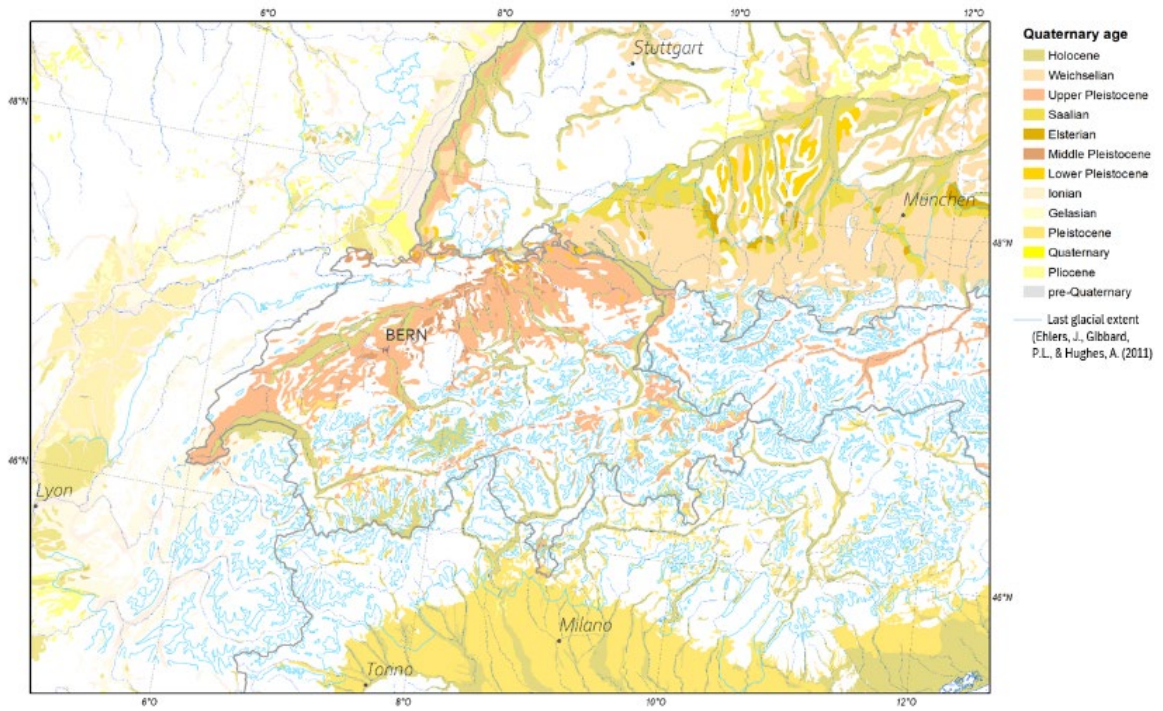

***Abb. 2:** Auszug aus der IQUAME 2500: Ausdehnung der letzten Vereisung in den Alpen und geologisches Alter der quartären Ablagerungen (Stand Juni 2022).*

Session 2 – Abrupt Climate Change and Extreme Events

The diatom record from Lake Chalco, central Mexico: a 150 ka record of climatic and environmental changes

Avendaño, Diana [1*]; Caballero, Margarita [2]; Ortega-Guerrero, Beatriz [2] & Lozano-García, Socorro [3]

[1] Posgrado de Ciencias de la Tierra, Instituto de Geofísica, Universidad Nacional Autónoma de México, Ciudad Universitaria, 04510, Ciudad de México, México.
[2] Laboratorio de Paleolimnología, Instituto de Geofísica, Universidad Nacional Autónoma de México, Ciudad Universitaria, CP 04510, Ciudad de México, México.
[3] Instituto de Geología, Universidad Nacional Autónoma de México, Ciudad Universitaria, CP 04510, Ciudad de México, México.
***** Corresponding author: da.avendano.v@ciencias.unam.mx

Lake Chalco in central Mexico, has an extraordinary sedimentary record that provides paleoenvironmental information of repeated changes from glacial to interglacial climates in the central Mexico transitional zone between the Nearctic and the Neotropical regions. The record presented in this work is 122 m long and covers the last 150 ka, therefore involving two major changes from glacial (MIS6 and MIS2) to interglacial (MIS5 and MIS1) climates. The objective of this work is to characterize the diatoms that are present in these sediments and to use them as paleolimnological indicators to infer hydrological balance changes in the region during the last 150 ka. These interpretations are also supported by geochemical data that are used as independent indicators of detrital input (Ti), authigenic carbonates (Ca/Ti). Detrended correspondence analyses (DCA) were used to evaluate the ecological turnover and to identify the diatom species associations that dominate along the sequence. The diatom assemblages range from freshwater to hyposaline and some species also point to cooler or warmer conditions. Two different response levels of ecological turnover from the diatom data set were observed. The greatest ecological turnover was during the glacial-interglacial transitions. The replacement involves a change between Stephanodiscus spp. present during cold and freshwater environments (late MIS6, MIS5d, MIS2) against Cyclotella spp. (MIS5e, MIS5c-a, MIS4, MIS3, early MIS1) in warm and high salinity conditions. To millennial-scale is marked by rapid shifts in the small Fragilariaceae spp. indicating rapid cooling intervals such as Heinrich events, while Cyclotella meneghiniana suggesting warm DO events. Climatic history over the last 150 ka indicates that MIS6 was colder and wetter than MIS2. In contrast, MIS5e and MIS1 could have similar warm and dry conditions, possibly MIS5e with more temperature due to the presence of the soda environment. The warmest condition in the record was during MIS5, this period was associated with the presence of no-modern-analog diatom communities dominated by successive peaks of Cyclotella spp. that had short stratigraphic distributions. By other hand, in MIS4 and MIS3 subsaline and freshwater conditions were alternated that point to rapid cooling events.

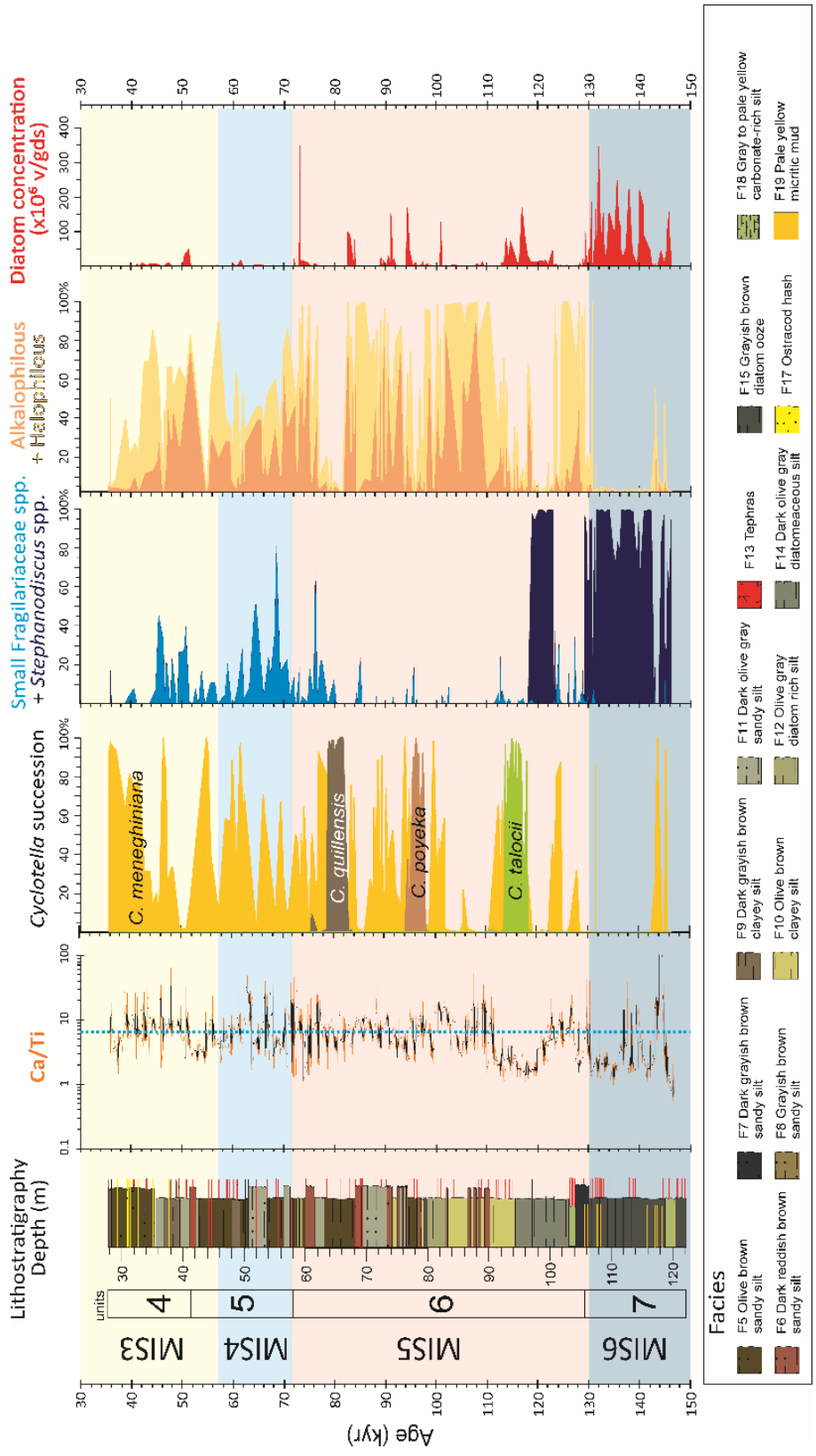

Fig. 1: *Chronology, Marine Isotopic Stages (MIS), stratigraphic units and lithostratigraphy of the CHA08 master sequence from Lake Chalco, Basin of Mexico. The graph shows the Ca/Ti geochemical data (blue line represents the mean value), diatom abundance of the four Cyclotella taxa in the sequence, of the four ecological diatom groupings (small Fragilariales, Stephanodiscus spp, alkaliphilous and halophilous taxa) and diatom valve concentration in valves per gram of dry sediment (v/gds).*

Session 5 – Earth Surface Processes and Environmental Change

Tracing alaas lake development with sedimentary ancient DNA and XRF-derived element distributions

Baisheva, Izabella[1,2,3*]; Pestryakova, Luidmila[3]; Levina, Sardana[3]; Glückler, Ramesh[1,2]; Biskaborn, Boris K.[1]; Andrew Vyse, Stuart[1]; Heim, Birgit[1]; Herzschuh, Ulrike[1,2,4] & **Stoof-Leichsenring, Kathleen R.**[1*]

[1] Polar Terrestrial Environmental Systems, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Potsdam, Germany
[2] Institute for Environmental Science and Geography, University of Potsdam, Potsdam, Germany
[3] Institute of Natural Sciences, North-Eastern Federal University of Yakutsk, Yakutsk, Russia
[4] Institute for Biochemistry and Biology, University of Potsdam, Potsdam, Germany
[*] Corresponding authors: izabella.baisheva@awi.de, kathleen.stoof-leichsenring@awi.de

In Central Yakutia (Siberia) livelihoods of local communities depend on alaas landscapes and lakes within. Development and dynamics of these alaas lakes are closely connected to climate change, permafrost thawing, catchment conditions, as well as land use. In order to reconstruct lake development throughout the Holocene we apply a sedimentary ancient DNA (sedaDNA) and biogeochemical approach to a sediment core from Lake Satagay, spanning the last c. 10,800 calibrated years before present (cal yrs BP). SedaDNA of diatoms and macrophytes and microfossil diatom analysis revealed a lake formation earlier than 10,700 cal yrs BP. SedaDNA approach detected 42 Amplicon Sequence Variants (ASVs) of diatom taxa, one ASV of Eustigmatophyceae (*Nannochloropsis*), and 12 ASVs of macrophytes. We relate diatom and macrophyte community changes to climate-driven shifts in water level, mineral and organic input, which result in variable water conductivity, in-lake productivity and sediment deposition. Along with biological proxies, XRF and sedimentological data were used to infer catchment-related and lake-internal geochemical changes. Both biological and geochemical data complemented each other and supported the following lake developmental stages of Lake Satagay: Initial lake formation during the Deglacial, lake deepening caused by rising temperatures in the Early Holocene, lake shallowing and high productivity during the Mid-Holocene and stable shallow conditions during the cooler Late Holocene. The recovered lake developmental stages coincide with known alaas stages and suggest that Lake Satagay has not yet reached the final stage of alaas lake development.

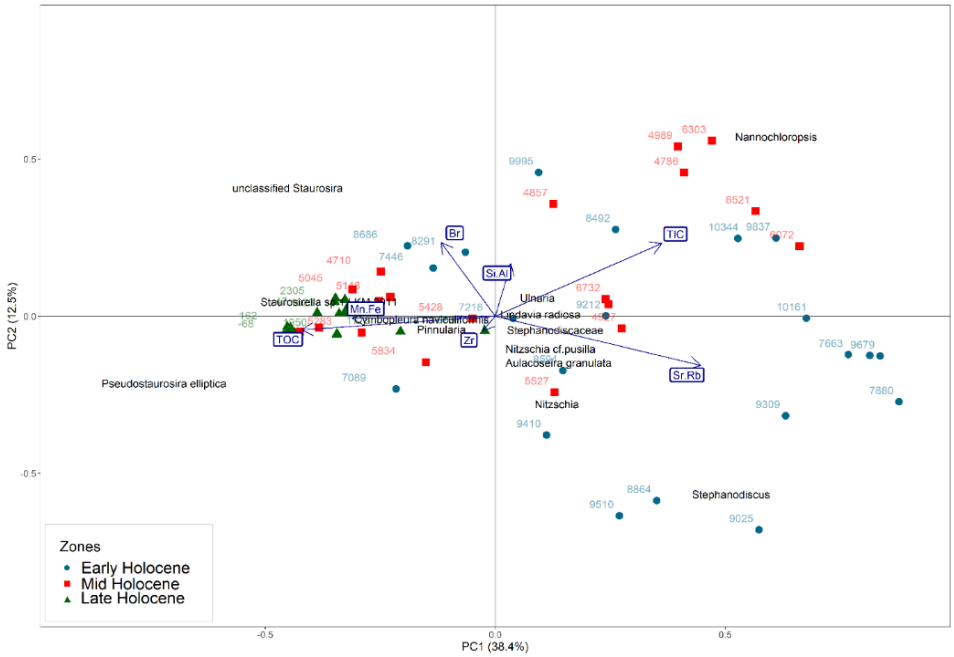

Fig. 1: *Biplot showing the results of the principal component analysis (PCA) performed on the most dominant sedaDNA diatoms and Nannochloropsis, indicating their relation to physicochemical variables within Holocene zones (numbers next to sample points refer to their age in cal yrs BP).*

Session 1 – Climate variability and warmer climates

Asymmetric development of sub-Arctic temperature regimes during interglacial MIS 11

Bauch, Henning A.*

Alfred-Wegener-Institut für Polar- und Meeresforschung c/o GEOMAR Kiel, Germany
* Corresponding author: hbauch@geomar.de

Understanding our present and future climate within the context of a paleo-perspective requires a closer scrutiny of some prominent, older warm periods from the later Quaternary. A number of observations and interpretations from different climate archives would imply varying impacts on the Arctic environment during these older interglacials. Among several past warm periods (e.g., marine isotope stage (MIS) 31) MIS 11 is often named as a particularly warm interglacial phase with a severe, global-scale climate connection. For the polar North it is suggested that the Greenland ice sheet was so strongly reduced in size that trees were able to thrive there. And as noted in records from Lake El’gygytgyn in NE Siberia, average temperatures and precipitations exceeded those of the Holocene by far. Indeed, this interpretation of a rather moist and warm climate over Siberia seems to be in line with previous assumptions based on diatom productivity records from Lake Baikal as well as other regional studies using speleothem growth data.

In terms of low-to-high latitude transfer of ocean-atmosphere heat across the North Atlantic the Nordic Seas comprise the major gateway into the Arctic Ocean. By investigating the oceanic surface ocean warmth during MIS 11 we cannot identify overly enhanced heat flow from the North Atlantic into the Arctic during this interglacial interval. As is further deduced from these data, subsequent warm periods (MIS 5e and MIS 1) appear to have experienced significantly warmer surface ocean conditions than MIS 11. Moreover, sediment records from close to Greenland would imply a very active East Greenland ice sheet margin throughout MIS11 with regard to iceberg release rates and occurrence of sea ice. It is therefore proposed that the rather cold surface conditions in the Nordic Seas, but comparatively warm temperature regimes over the Pacific sector of the Arctic, either resulted in or caused a distinct cross-arctic climate contrast. This in turn significantly affected arctic albedo and associated feedback factors, including seasonal sea ice extent as well as circum-arctic vegetation and snow cover which all relate to atmospheric moisture supply.

Session 2 – Abrupt Climate Change and Extreme Events

Hurricane impacts on lake hydrogeochemistry as recorded by ostracod stable C and O isotopes in Lago Enriquillo, Dominican Republic

Berndt, Christopher [1*]; Haberzettl, Torsten[2]; Böttcher, Michael Ernst[3,4,5]; Meyer, Tammo[6]; José Clases, Sandra[7]; Arias Santos, Eddy Josue [7]; García Cocco, Edwin Rafael[7] & Wrozyna, Claudia[1]

[1] University of Greifswald, Institute for Geography and Geology, Chair of Paleontology and Historical Geology, Greifswald, Germany
[2] University of Greifswald, Institute for Geography and Geology, Physical Geography, Greifswald, Germany
[3] University of Greifswald, Institute for Geography and Geology, Chair of Marine Geochemistry, Greifswald, Germany
[4] Leibniz IOW, Geochemistry and Isotope Biogeochemistry Group, Warnemünde, Germany
[5] University of Rostock, Interdisciplinary Faculty, Rostock, Germany
[6] University of Greifswald, Institute for Geography and Geology, Workgroup for Applied Geology, Greifswald, Germany
[7] Servicio Geologico Nacional, Santo Domingo, Dominican Republic
* Corresponding autor: christopher.berndt@uni-greifswald.de

Keywords: Neotropics, tropical cyclones, Ostracoda, stable oxygen and carbon isotopes, morphology

Hurricanes are severe tropical storms often causing huge devastations through wind and floodings. However, the recurrence rate of these storms is not well understood due to a lack suitable proxies. At present, only fragmented hurricane records based on overwash deposits preclude a hurricane activity reconstruction and an unambiguous differentiation between tropical cyclone (TC) and tsunami deposits. Instead, the water transport over long distances through TCs creates distinctly lighter $\delta^{18}O$ signatures. This results in a distinct isotopic signature for each water body along its track. Lago Enriquillo is our 'natural laboratory' for calibration of a novel ostracod-based stable isotope approach using geochemical signatures ($\delta^{18}O$, $\delta^{13}C$) of ostracod valves, along with the integration of ecological and morphological data for reconstruction of paleo-TCs. The lake is located in the Main Development Region (MDR) of Atlantic TCs and provides a strong sensitivity to hydrological changes, i.e., annual and seasonal shifts of precipitation, resulting in drastic lake level changes within only few years.

Ostracods, microcrustaceans living in a wide variety of aquatic environments, precipitate their calcitic carapaces directly from the surrounding waters within a short time and often provide seasonal life cycles (i.e., calcification). Thus, stable isotope compositions of ostracod valves can be used as high-resolution proxy for hydrochemical conditions and variations.

During fieldwork in March 2022, we collected 13 surface sediment and water samples from the deepest to shallowest parts of the lake (down to 25 m water depth) in order to determine the spatial distribution of modern ostracod species and characterise their stable isotope ($\delta^{18}O$, $\delta^{13}C$) signatures in relation to seasonal changes of the hydrochemistry (dry season vs. rainy or `hurricane´ season).

Stable oxygen and carbon isotope values from modern waters are variable (range of $\delta^{18}O$: -4.09 to 4.06 ‰ and $\delta^{13}C$: -9.18 to 0.01 ‰). While $\delta^{18}O$ values are only different between inflows and lake water, $\delta^{13}C$ values differ between shallower, well mixed lake waters and the deepest lake water as well as between the water from two sampled inflows.

Modern ostracod species assemblages in the current hypersaline lake are characterized by a low diversity and distinct spatial distribution. The dominant species *Cyprideis similis* Brady, 1869 and *Thalassocypria sarbui* Maddocks & Iliffe, 1993 occur in high numbers only in shallower water depths between 2 and 8 m. While biocoenosis and thanatocoenosis data are showing a similar distribution of the current fauna, the taphocoenoses data from those samples contain valves of total 13 different species, i.e., *Cyprideis salebrosa* Maddocks & Iliffe, 1993 and *Perissocytheridea cribrosa* (Klie, 1933) were found frequently inside the samples. This implies that modern species assemblages are representative for the current conditions inside the lake, but previous environmental changes have caused highly different species assemblages. Thus, the stable isotope analysis will require the use of two or more species to reconstruct the past hurricane activity and a variable water inflow may modify the lake's isotopic signature significantly.

Session 1 – Climate variability and warmer climates

Multivariate statistical analysis of geochemical and geophysical data of lacustrine sediments from Holzmaar (West-Eifel Volcanic Field, Germany) and linkages to climate and anthropogenic history

Birlo, Stella[1*]; Ohlendorf, Christian[1]; Gebhardt, Catalina[2] & Zolitschka, Bernd[1]

[1] University of Bremen, Institute of Geography, GEOPOLAR, Bremen, Germany
[2] Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung, Bremerhaven, Germany
[*] Corresponding author: sbirlo@uni-bremen.de

Terrestrial sediments are valuable archives to reconstruct natural and anthropogenic influences on the environment on regional and global scales. The well-studied Holzmaar (West-Eifel Volcanic Field, Germany) provides precious environmental information not only for the Eifel region but also about larger-scaled climatic patterns back to the Late Pleistocene. The well-preserved diatomaceous varves were counted already in the late 1980s and provided a high-resolution calendar-year chronology that formed the basis for intensive research of the lake, which started back then (Zolitschka, 1990).

We revisited Holzmaar in 2019 and took four parallel sediment piston cores at the deepest point of the lake to conduct multiproxy analyses and compiled the new composite profile HZM19. An updated chronology (VT-22) (Birlo et al., in. prep.) integrates the previous varve chronology (VT-99), Bayesian modelling of published radiocarbon dates, as well as the new age of the Laacher See Tephra. This chronology was used to set up a continuous high-resolution geochemical and geophysical record of HZM19, obtained with micro X-ray fluorescence scanning and magnetic susceptibility. We use multivariate statistics, e.g. principal component analysis and unsupervised agglomerative clustering, to analyze the chemical and physical composition of the Holocene sediments in order to obtain detailed insight into past environmental changes. The overall result mirrors the lithology of Holzmaar sediments. Sections with more minerogenic components (Fig. 1: Clusters 1, 4; Lithozones H5, H6, H9, H11) contrast with sections that are characterized by less minerogenic (Fig. 1: Clusters 2, 3; Lithozones H4, H8, H10, H12). All sections reveal an organic matrix due to high abundance of diatoms (García et al., subm.). Some of the transitions between clusters along the profile can be related to changes in climate. For example, higher amounts of calcium are observed until the end of the Holocene Climatic Optimum (ca. 6000 cal. BP), covered by Clusters 2 and 4, which might be related to increased primary productivity. Other changes, however, are clearly related to human impact on the environment, e.g. by deforestation in the catchment of Holzmaar during the Roman Period leading to increased influx of clastic material as seen in Lithozone H9, where more minerogenic Clusters 1 and 4 become abundant.

The well-preserved varves and the undisturbed Holocene record of Holzmaar provide a high potential to reveal detailed information about past natural and anthropogenic processes on regional and global scales. Here we present first results and interpretations of the high-resolution geochemical and geophysical analyses.

References

Birlo, S., Tylmann, W., Zolitschka, B., in. prep. Bayesian age-depth modelling applied to varve counting and radiometric dating to develop a high-resolution chronology for the new composite sediment profile from Holzmaar (West-Eifel Volcanic Field, Germany).

García, M.L., Birlo, S., Zolitschka, B., subm. Paleoenvironmental changes of the last 16,000 years based on diatom and geochemical stratigraphies from Holzmaar (West-Eifel Volcanic Field, Germany). Quaternary Science Reviews Manuscript submitted for publication.

Zolitschka, B., 1990. Jahreszeitlich geschichtete Seesedimente ausgewählter Eifelmaare - paläolimnologische Untersuchung als Beitrag zur spät- und postglazialen Klima- und Besiedlungsgeschichte. Dokumenta naturae 60, 1–226.

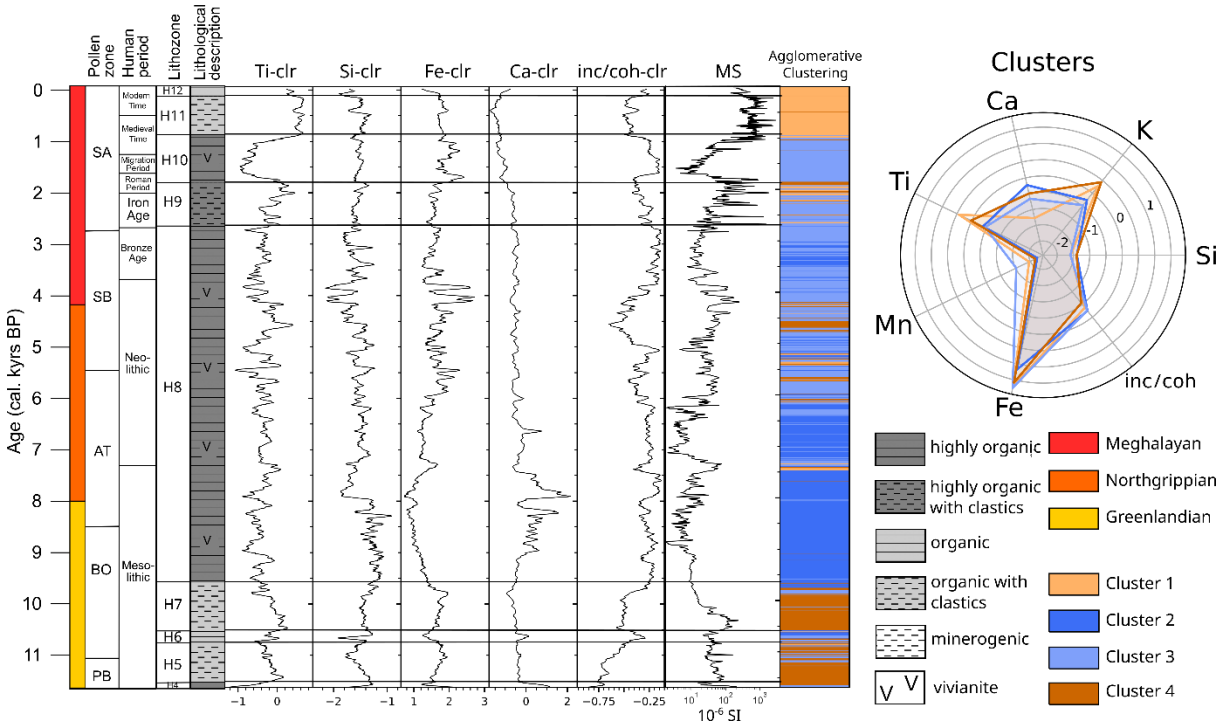

Fig. 1: *Holocene geochemical and geophysical data of Holzmaar, as well as unsupervised agglomerative clustering vs. time based on VT-22. From left to right: Holocene stages, pollen zones (PB: Preboreal, BO: Boreal, AT, Atlantic, SB: Subboreal, SA: Subatlantic), human periods, lithology with lithozones H1 - H12, lithological description, centred log-ratios (clr) of elemental composition (Ti: titanium, Si: silicon, Fe: iron, Ca: calcium, inc/coh: incoherent/coherent scatter ratio), magnetic susceptibility (MS), results of the clustering approach with elemental composition for each Cluster (Clusters 1-4) shown as polar plot (Mn: manganese, K: potassium).*

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Environmental and sedimentary responses of Groß-Glienicker See (Brandenburg-Berlin) to natural and anthropogenic forcings since the Last Glacial Maximum

Biskaborn, Boris K.[1,2*]; Schnitt, Adrian[1,2]; Rothe, Udo[3]; Barsch, Jenny[1,2]; Meyer, Hanno[1]; Stoof-Leichsenring, Kathleen[1]; Herzschuh, Ulrike[1,2,4]; Kahl, Jan[1] & Diekmann, Bernhard[1,2]

[1] Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Research Unit Potsdam, Potsdam, Germany
[2] Institute of Geosciences, University of Potsdam, Potsdam, Germany
[3] Naturkundemuseum Potsdam, Potsdam, Germany
[4] Institute of Biochemistry and Biology, University of Potsdam, Potsdam, Germany
* Corresponding author: boris.biskaborn@awi.de

The Holocene environmental history of NE Germany is strongly influenced by postglacial climate development and human impact. The objective of this work was to infer millennial-scale man-made and natural palaeoenvironmental variability in a lake system close to the German capital Berlin. We used a Hybrid UWITEC 90 mm Niederreiter Piston Coring System to retrieve an 8 m long sediment core from Groß Glienicker See situated at the western border of Berlin to Brandenburg (Fig. 1). We used a radiocarbon approach to date the sediments back to ca. 20.000 years before present (BP). In addition to logging of magnetic susceptibility, we analysed elements by XRF core scanning, and determined organic carbon (TC, TN, TOC), mercury (Hg), and grain-size distributions in single samples of the sediment core. Our results affirm the application of XRF-based sediment-geochemical proxies as effective tracers of both palaeolimnological variability and terrestrial changes in the catchment. We found the Laacher See Tephra, showing peaks in Al and Ti concentrations, as well as other proxy perturbations at around 13.000 years BP, associated to environmental impacts from the volcanic eruption. During the Holocene, environmental variability led to changes in lake level and water chemistry. Direct anthropogenic environmental impact can be detected from the upper part of the sediment core, related to the industrial period, where mercury concentrations show an about 100-fold increase compared to pre-industrial times.

Fig. 1: *UWITEC Niederreiter HYBRID 90 mm Piston Coring System operated on Groß Glienicker See in June 2020 (Foto: AWI)*

Session 2 – Abrupt Climate Change and Extreme Events

The 8.2 ka event in the Dead Sea: tracking a high-latitude disturbance in the Mediterranean

Blanchet, Cécile[1]*; Nwaigy, Assil[2]; Jurikova, Hana[3]; Tjallingii, Rik[1]; Schwab, Markus J.[1] & Brauer, Achim[1]

[1] GFZ Potsdam, Section Climate evolution and landscape dynamics, Potsdam, Germany
[2] University Potsdam, Potsdam, Germany
[3] University of St Andrews; School of Earth & Environmental Sciences; St Andrews, UK
* Corresponding author: blanchet@gfz-potsdam.de

The last deglaciation is an ideal time interval to investigate the effect of climatic and oceanic disturbances occurring at high latitude on the hydrological regimes of the Mediterranean Sea. In particular, a series of disruptions of the Atlantic Meridional Oceanic Circulation (AMOC) has punctuated the transition from glacial to interglacial conditions, with the so-called 8.2 ka event being the youngest one. After the publication of recent results showing the existence of instable climatic conditions in the Dead Sea during the Younger Dryas (Müller et al., 2022), we examine here the environmental record during the 8.2 ka event to illuminate the effects of the background climate (colder to warmer) on hydrological distrubances linked to AMOC disruptions. We performed a coupled limnological and geochemical analysis of sediments deposited in the deeper part of the Dead Sea (IDCP site 5017A), which showed the occurrence of repeated mass wasting deposits related to intense erosive activity in the watershed of the Dead Sea. An identified hiatus in outcrop sequences from western lake shores suggests a drop in lake level at that time (Migowski et al., 2006). Ongoing analyses of sediment provenance and classification of mass wasting events will provide additional insights on the precise processes operating at that time, as well as the climatic regimes associated.

References

Müller, D., Neugebauer, I., Ben Dor, Y., Enzel, Y., Schwab, M. J., Tjallingii, R., and Brauer, A.: Phases of stability during major hydroclimate change ending the Last Glacial in the Levant, Sci Rep, 12, 6052, https://doi.org/10.1038/s41598-022-10217-9, 2022.

Migowski, C., Stein, M., Prasad, S., Negendank, J. F. W., and Agnon, A.: Holocene Climate Variability and Cultural Evolution in the Near East from the Dead Sea Sedimentary Record, 66, 421–431, https://doi.org/10.1016/j.yqres.2006.06.010, 2006.

Session 5 – Earth Surface Processes and Environmental Change

Permafrost evolution in the last glacial period in the North-Central European Lowlands

Błaszkiewicz, Mirosław*

Polish Academy of Sciences, Institute of Geography and Spatial Organisation, Toruń, Poland
* Corresponding author: mirek@geopan.torun.pl

The transgression of the Last Ice Sheet divided the Central European Lowlands into two different zones. The areas shaped during older glaciations, which lie to the south of the Last Glacial Maximum, underwent intensive periglacial transformation during practically the entire Weichselian. The contemporary relief of these parts of Poland very clearly record the long-term occurrence of permafrost. Meanwhile, the presence of periglacial conditions in areas covered by the last glaciation and their role in transforming landscape is still the subject of scientific debate. Both the encroachment of permafrost into areas subject to systematic deglaciation during the ice sheet recession and the possible persistence of the permafrost formed during its transgression are problematic.

In the course of geomorphological studies to date in the part of the Central European Lowlands within the range of the LGM, a model of the gradual encroachment of permafrost into areas exposed during ice sheet recession has been developed (Liedtke, 1993; Kozarski, 1995). However, at the same time, these models assumed that permafrost from the ice sheet transgression phase was almost totally degraded under the ice sheet. The latest research from various areas covered by the last glaciation, especially the Laurentide Ice Sheet, indicate that the permafrost did not disappear completely under the ice sheet, and that its disappearance was even limited to just a small zone within the range of subglacial water circulation (Clayton et al., 2001; Lacelle et al., 2004). Recently, including in the part of Europe within the reach of the last ice sheet, the possibility of permafrost from the transgression phase having been partially preserved under the ice sheet has been considered. One significant note in this discussion is the assumption that permafrost beneath the ice sheet played a major role in the formation of subglacial drainage channels and tunnel valleys (Piotrowski et al., 2009), as well as other forms of subglacial relief such as drumlins (Hermanowski, Piotrowski, 2019).

The research carried out so far in part of the North-Central European Lowlands covered by the last ice sheet has documented a number of structures and forms typical of periglacial zones, such as: frost-cracks, cryoturbation in soil profiles, wind-erosion microforms on the surfaces of erratic boulders, and oriented kettle holes, which are associated with icing (Kozarski, 1995; Błaszkiewicz, 2011; Van Loon et al., 2012). Recently, in Gdańsk Pomerania, a large complex of enigmatic ring forms was detected and preliminarily documented whose genesis may be related to permafrost and the occurrence within it of taliks associated with groundwater upwelling (Błaszkiewicz, Danel, 2019).

However, the vast majority of melt-out forms in young moraine landscape regions are associated with the presence of buried blocks of dead glacial ice. The diversity in age of melt-out processes that is presented in the literature and, moreover, the proof that blocks of dead ice could persist to the beginning of the Holocene, confirms the variable dynamics of permafrost degradation and that permafrost did not disappear before the early Holocene (the transition of the pre-Boreal to Boreal), (Błaszkiewicz, 2011; Błaszkiewicz et al., 2015). In recent years, in a borehole at Szypliszki near Suwałki in north-eastern Poland (an area within the range of the last ice sheet), permafrost was documented at a depth of 375 m (Szewczyk, Nawrocki, 2011). The persistence of relict permafrost in this region is associated with extremely low heat flux caused by the peculiarity of the geological structure (an anorthosite massif). We might, therefore, somewhat perversely claim that the young-glacial area of Poland has not yet undergone complete degradation of its permafrost.

This work was prepared as part of grant No. 2019/35/B/HS3/03933 financed by the National Science Centre (Poland).

References

Błaszkiewicz, M., 2011. Timing of the final disappearance of permafrost in the Central European Lowland as reconstructed from the evolution of lakes in N Poland. Geological Quarterly, 55, 4, 361–374.

Błaszkiewicz, M., Danel, W., 2019. Formy pierścieniowe w rejonie Wejherowa jako prawdopodobne pozostałości po-pingo i ich znaczenie dla paleogeografii późnego glacjału w północnej Polsce. Przegląd Geograficzny, 91, 3, 405-419.

Błaszkiewicz M., et al., 2015. Climatic and morphological controls on diachronous postglacial lake and River valleye volution in the area of Last Glaciation, northern Poland. Quaternary Science Reviews, 109, 13–27.

Clayton, L., Attig, J. W., Mickelson, D. M., 2001. Effects of late Pleistocene permafrost on the landscape of Wisconsin, USA. Boreas, 30, 173–188.

Hermanowski, P., Piotrowski, J. A., 2019. Groundwater flow under a paleo-ice stream of the Scandinavian Ice Sheet and its implications for the formation of Stargard drumlin field, NW Poland. Journal of Geophysical Research: Earth Surface, 124, 1720-1741.

Kozarski, S., 1995. Deglacjacja północno-zachodniej Polski: warunki środowiska i transformacja geosystemu (∼20 ka → 10 ka BP*).* Dokumentacja Geograficzna, IGiPZ PAN, 1, Warszawa.

Lacelle, D., et al., 2004. Segregated-intrusive ice of subglacial meltwater origin in retrogressive thaw flow headwalls, Richardson Mountains, NWT, Canada. Quaternary Science Reviews, 23, 681–696.

Liedtke, H., 1993. Phasen periglaziär-geomorphologischer Prägung während der Weichseleiszeit im norddeutschen Tiefland, Zeitschrift für Geomorphologie, 93, 69–94.

Piotrowski, J. A., Hermanowski, P., Piechota, A. M., 2009. Meltwater discharge through the subglacial bed and its land-forming consequences from numerical experiments in the Polish lowland during the last glaciation. Earth Surface Processes and Landforms, 34, 481-492.

Szewczyk, J., Nawrocki, J., 2011. Deep-seated relict permafrost in northeastern Poland*.* Boreas, 40, 3, 385–388.

Van Loon, A., Błaszkiewicz, M., Degórski, M., 2012. The role of permafrost in shaping the Late Glacial relief of northern Poland*.* Netherlands Journal of Geosciences, 91, 1–2, 223–231.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

A Holocene long record of invertebrate biodiversity change from Lake Sidi Ali, Morocco

Bolland, Alexander[1*]; Dietze, Elisabeth[2]; Schneider, Birgit[1]; Benkaddour, Abdelfattah[3]; Fletcher, William[4]; Mischke, Steffen[5]; Pichat, Sylvain[6] & Zielhofer, Christoph[1]

[1] University of Leipzig, Institute of Geography, Leipzig, Germany
[2] Alfred Wegener Institute for Polar and Marine Research, Polar Terrestrial Environmental Systems, Research Unit Potsdam, Potsdam, Germany
[3] Cadi Ayyad University, Department of Earth Sciences, Marrakech, Morocco
[4] University of Manchester, School of Environment and Development, Manchester, UK
[5] University of Iceland, School of Engineering and Natural Sciences, Reykjavík, Iceland
[6] University of Lyon, Laboratoire de Geologie de Lyon (LGL-TPE), Lyon, France
[*] Corresponding author: alexander.bolland@uni-leipzig.de

Western Mediterranean North Africa (WMNA) is one of the world’s most sensitive regions to climatic change and is projected to experience large decreases in precipitation and increased heat stress within the next century. Therefore, the region is vulnerable to droughts with countries like Morocco already investing enormous capital resources into surface water management. Reduced precipitation and increased drought occurrence will reduce the available habitat for aquatic fauna, and changing water parameters such as water temperature and flow will modify which species are able to survive in those habitats. Furthermore, anthropogenic surface water management (damning rivers and redirecting flow) will exacerbate local environmental change. To date the biodiversity of aquatic invertebrates in the lakes of WMNA is unknown as survey data is either incomplete or lacking. As a result, the rates of change of aquatic invertebrate biodiversity resulting from recent anthropogenic change are also unknown. There is therefore a need, not only to establish how recent anthropogenic change has affected aquatic biodiversity, but also to place that recent change into its long-term context.

We present a new Holocene-long invertebrate record from Lake Sidi Ali in the Middle Atlas Mountains, Morocco. The new record describes changes in abundances of Amphipoda, Bryozoa, Chironomidae, Chaoboridae, Daphniidae, Ephemeroptera, Gastropoda, Oribatida, Ostracoda, Plecoptera and Tricoptera. Where further taxonomic identification was possible, we have also reconstructed assemblage changes within those groups. The largest changes in the invertebrate assemblages are associated with the Early to Middle Holocene transition and decreasing lake levels (Zielhofer et al, 2017) with Ceriodaphnia-type ephippia declining from 80% of the total invertebrate assemblage to less than 5%. The Early to Middle Holocene transition is also associated with the first occurrence of Chaoboridae in the record, which reached over 20% of the total invertebrate assemblage and suggest that the oxygen content of the hypolimnion decreased at this time. Similar transitions were observed in the group Chironomidae, where *Psectrocladius sordidellus*-type, which dominated the chironomid assemblage during the end of the Younger Dryas and Early Holocene representing >70% of the chironomid assemblage, declined to <10% and was replaced by *Polypedilum nubeculosum*-type which dominated throughout the Middle Holocene. Interestingly, chironomid abundance and diversity increase to a maximum in the most recent sediments, representative of Sidi Ali becoming anthropogenically affected.

References

Zielhofer, C., Fletcher, W.J., Mischke, S., De Batist, M., Campbell, J.F., Joannin, S., Tjallingii, R., El Hamouti, N., Junginger, A., Stele, A. and Bussmann, J., 2017a. Atlantic forcing of Western Mediterranean winter rain minima during the last 12,000 years. *Quat. Sci. Rev.*, 157, pp.29-51.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Ableitung einer möglichen zukünftigen subglazialen Erosionstiefe für Norddeutschland aus der GIS – gestützten Oberflächenanalyse der Quartärbasis

Breuer, Sonja[1*]; Lang, Jörg[1]; Bebiolka, Anke[2] & Noak, Vera[2]

[1] Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Stilleweg 2, 30655 Hannover
[2] Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Wilhelmstr. 25-30, 13593 Berlin
* Kontakt: sonja.breuer@bgr.de

Subglaziale Rinnen („tunnel valleys“) gehören zu den tiefsten Erosionsformen in ehemals vergletscherten Gebieten. Meistens treten diese Strukturen durch die nachträgliche Verfüllung an der Erdoberfläche nicht mehr zu Tage. Trotz einer langen Forschungsgeschichte bestehen noch zahlreiche offene Fragen zur Genese und Entwicklung subglazialer Rinnen und ihrer Füllungen. Rinnenfüllungen bilden in Norddeutschland wichtige Aquifere, die in mehrere Stockwerke gegliedert sein können.

Für die Langzeitsicherheit von Endlagern in tiefen geologischen Formationen stellt die Prognose zur Bildung tiefer Rinnen während möglicher zukünftiger Eiszeiten eine große Herausforderung dar. Eine solche Prognose ist notwendig, da das Standortauswahlgesetz eine minimale Teufe eines einschlusswirksamen Gebirgsbereichs (ewG) unterhalb der größten zu erwartenden Tiefe von exogenen Prozessen, deren direkte oder indirekte Auswirkungen zur Beeinträchtigung der Integrität eines ewG führen können, vorschreibt. Subglaziale Rinnen werden indirekt als „eiszeitlich bedingte intensive Erosion“ genannt (StandAG 2017: § 23 Abs. 5 Nr. 3).

Der Fachbereich Langzeitsicherheit der Bundesanstalt für Geowissenschaften und Rohstoffe (BGR) untersucht in zwei Projekten die Möglichkeiten, ob und wie die Bildung, die Verbreitung und die Geometrie zukünftiger subglazialer Rinnen prognostiziert werden können. Dazu wird der Einfluss des geologischen Untergrundes auf die Lage und den Verlauf subglazialer Rinnen betrachtet. Vorhandene Daten werden neu kombiniert und interpretiert, um der Frage nachzugehen, inwiefern Senkungszonen, Störungen, Salzstrukturen oder bestimmte Lithologien die Rinnenbildung begünstigen oder behindern.

Im Rahmen des Posters werden die beiden Projekte präsentiert und deren unterschiedliche Kernfragen thematisiert. Es wird eine erste GIS-gestützte Auswertung der von den staatlichen geologischen Diensten zur Nutzung überlassenen Quartärbasisflächen vorgestellt und deren Nutzen diskutiert. Folgende Kernfragen wollen wir betrachten: Welche Größen aus den Berechnungen zur Hangneigung, Ausrichtung des Hanges und aus den Analysen zur Abflussberechnung (Spatial Analyst Tools) können genutzt werden, um Rückschlüsse auf den Verlauf der pleistozänen Rinnen zu ziehen? Welche Informationen aus den GIS-Auswertungen der Quartärbasisflächen können abgeleitet werden, wenn diese Informationen mit den Flächeninformationen der geologischen Einheiten im Untergrund verschnitten werden? Können anhand der Rinnengeometrie Rückschlüsse auf unterschiedliche Eisvorstöße gezogen und so den Rinnen ein relatives Alter zugewiesen werden?

Literatur

StandAG: Standortauswahlgesetz vom 5. Mai 2017 (BGBl. I S. 1074), das zuletzt durch Artikel 247 der Verordnung vom 19. Juni 2020 (BGBl. I S. 1328) geändert worden ist.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Eine aktualisierte Quartärbasis für Niedersachsen – Erste Einblicke in die Modellierung

Bruns, Ines[1,*]; Fischer, Kerstin[1]; Meinsen, Janine[1] & Wangenheim, Cornelia[1]

[1] Landesamt für Bergbau, Energie und Geologie, Stilleweg 2, 30655 Hannover, Germany
[*] Kontakt: ines.bruns@lbeg.niedersachsen.de

Die hochenergetischen Prozesse während der Elster-Kaltzeit haben u.a. die Basis des quartären Lockergesteinskörpers in Niedersachsen maßgeblich beeinflusst. Es zeigt sich daher ein vielfältiges Relief der Quartärbasis mit tief in den tertiären Untergrund eingeschnittenen Rinnen. Diese können wenige 10er Meter bis zu 400 m u. NN tief reichen (Kuster & Meyer 1979). Die quartären Lockersedimente sind für die Rohstoffgewinnung und die Grundwasserverbreitung und –bewegung von großer Bedeutung. Außerdem kann die Tiefenlage der Quartärbasis einen Anhaltspunkt für die Prognose der Erosionstiefe möglicher zukünftiger Vereisungen darstellen, z.B. im Rahmen der Suche nach einem Endlager für radioaktive Abfälle. Die bisherigen Erkenntnisse zur Tiefenlage der Quartärbasis in Niedersachsen sind in einem Isolinienplan im Maßstab 1:500.000 zusammengefasst (Kuster & Meyer 1995). Dieser bildet die Grundlage der vorgestellten Neubearbeitung und wird mit Hilfe der Interpretation und Auswertung von z.B. Bohrungen der „Bohrdatenbank Niedersachsen“ (BDN) inklusive Bohrlochmessungen und Datierungen, (3D-) Seismik, geologischen Profilschnitten und kleinräumigen 3D-Lockergesteinsmodellen aktualisiert. Das Ziel ist es, die Quartärbasis Niedersachsens in Form einer 3D-Modellfläche und als überarbeitete Isolinienkarte bereitzustellen.

Für die 3D-Modellierung mit der Software SKUA-GOCAD™ (Emerson E&P Software) müssen die Grunddaten entsprechend aufbereitet werden. Durch eine Vorauswahl wurden aus der BDN etwa 180.000 Bohrungen selektiert und semi-automatisiert ausgewertet und geprüft. Den Bohrungen zugehörige Logs und Datierungen werden gesondert berücksichtigt und mit den Eintragungen im Schichtenverzeichnis abgeglichen. Die so gewonnenen Punktdaten fließen zusammen mit den am LBEG erstellten geologischen Profilschnitten und den 3D-Lockergesteinsmodellen (https://nibis.lbeg.de/cardomap3/) in die 3D-Modellierung ein und liefern detaillierte Hinweise über die lokale Tiefenlage der Quartärbasis. Außerdem lässt sich in reprozessierten und tiefenmigrierten 3D-seismischen Daten der KW-Industrie zum Teil der Verlauf und ggf. die Tiefe der eingeschnittenen quartären Rinnen verfolgen und ebenfalls in die Modellierung integrieren.

Das erste fertiggestellte Teilmodell in der Geest im Raum Oldenburg (TK100-Kachel C3114) gibt einen Einblick in die Neubearbeitung. Eine besondere Herausforderung in diesem Gebiet stellt die unklare Abgrenzung von glazifluviatilen, quartären Ablagerungen zu terrestrischen Ablagerungen des Pliozäns dar. Diese ist sowohl aus der Beschreibung in den Schichtenverzeichnissen als auch aus den Logs nicht immer eindeutig ableitbar. Allerdings ermöglicht die vielfältige Eingangsdatenbasis eine Neumodellierung der Quartärbasis mit einem wesentlich höheren Detailgrad. Beispielsweise lassen sich veränderte Rinnengeometrien bezogen auf Tiefenlage und Verlauf im Vergleich zur Datengrundlage (Kuster & Meyer 1995) erkennen (Abb. 1).

Quellen

Kuster, H.; Meyer, K.-D. (1979): Glaziäre Rinnen im mittleren und nordöstlichen Niedersachsen, Eiszeitalter und Gegenwart 29, 135-156; Hannover.

Kuster, H.; Meyer, K.-D. (1995): Karte der Lage der Quartärbasis in Niedersachsen und Bremen, 1:500 000; Hannover.

NIBIS Kartenserver: https://nibis.lbeg.de/cardomap3/

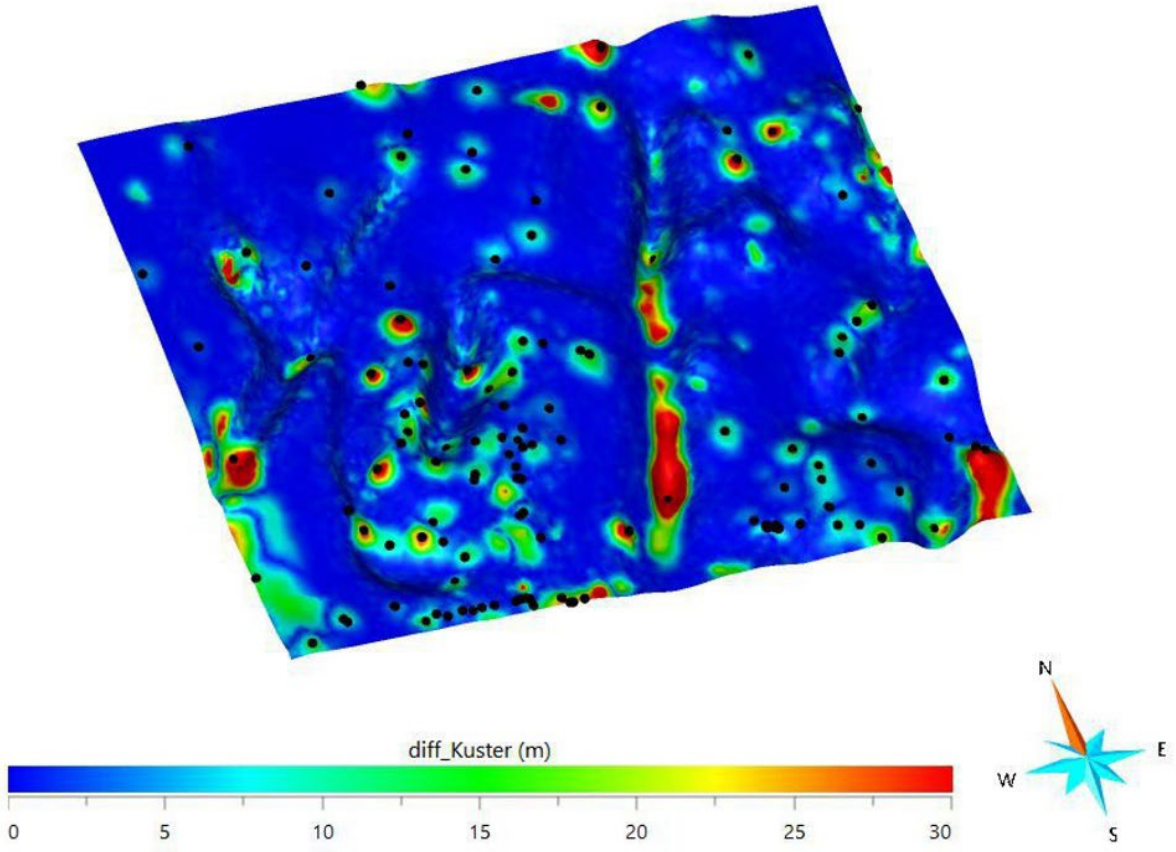

***Abb. 1**: Differenzen zwischen neuer Modellierung und der Quartärbasis nach Kuster & Meyer (1995). Rote Farben zeigen alle Abweichungen über 30 m und schwarze Punkte zeigen die für die Modellierung verwendeten Bohrungen. Die Ausdehnung des Ausschnitts beträgt ca. 30x30 km.*

Session 1 – Climate variability and warmer climates

Insights into our future from past interglacials

Capron, Émilie*

Institut des Géosciences de l'Environnement, Université Grenoble Alpes, CNRS, IRD, Grenoble-INP
* Corresponding author: emilie.capron@univ-grenoble-alpes.fr

The anthropogenic-induced high-latitude warming has global climatic implications due to polar ice mass loss, sea level rise and ocean circulation changes. To evaluate the risk of major current and future environmental changes, it is essential to explore climate dynamics and associated cryosphere and carbon cycle feedbacks that occurred during past warm time intervals.

Through this talk, I would like to illustrate that past interglacials are of particular interest in this context. They provide a basis for comparison with our current interglacial. Also, interglacials of the past 450 ka exhibit a polar warming comparable to that projected by 2100 due to specific combinations of orbital and CO_2 forcing.

First, I will use as a case-study the last interglacial (129-116 ka), a warm interval characterized by a global sea level 6-9 m higher than today. I will present the advances in characterizing global and regional climate variations during this warm interval combining climate data syntheses from natural archives and outputs from state-of-the-art climate models. The results provide an improved understanding of the mechanisms and feedbacks occurring during this warmer-than-preindustrial period. Second, I will present on-going and future efforts to extend such integrative model-data approach to older interglacials such as Marine Isotopic Stages 7, 9 and 11.

Finally, I will delineate some of the major research questions that still need to be resolved and future research directions that should be taken, as defined recently by the paleoclimate, sea-level and ice-sheet research communities in order to increase confidence in the use of past interglacial climate, ice-sheet and sea-level reconstructions to constrain future predictions.

Session 3 – Synchronisation and Dating of Proxy Records

Synchronizing the Baltic Sea and Lake Kälksjön sediment records using the cosmogenic radionuclide ^{10}Be

Czymzik, Markus[1*]; Brauer, Achim[2,3]; Kaiser, Jérôme[1]; Christl, Marcus[4]; Schwab, Markus J.[2] & Arz, Helge W.[1]

[1] Leibniz Institute for Baltic Sea Research Warnemünde - IOW, Marine Geology, Rostock, Germany
[2] GFZ - German Research Centre for Geosciences, Climate Dynamics and Landscape Evolution, Potsdam, Germany
[3] University of Potsdam, Institute of Geosciences, Potsdam, Germany
[4] ETH Zurich, Laboratory of Ion Beam Physics, Zurich, Switzerland
* Corresponding author: markus.czymzik@io-warnemuende.de

The marine-terrestrial Baltic ecosystem is sensitive to a range of environmental forcings and thresholds (BACC II, 2015). Multi-archive investigations of its evolution require a precise synchronization of the considered archives. Here, we apply globally common cosmogenic radionuclide production rate variations to synchronize Mid-Holocene ^{10}Be records from brackish Western Gotland Basin (Baltic Sea) and terrestrial Lake Kälksjön (central Sweden) sediments to the ^{14}C production time-series from the IntCal20 calibration curve, using automated wiggle-matching (Czymzik et al., 2020; Reimer et al., 2020).

The ^{10}Be records from Western Gotland Basin and Lake Kälksjön sediments predominantly reveal well-preserved time-series of decadal changes in cosmogenic radionuclide production from ~6500 to 5000 a BP. An exception is the period from ~6300 to 6100 a BP in the Western Gotland Basin record comprising non-

laminated sediments and a ^{10}Be production signal at a reduced centennial resolution (the remaining investigated sediments from both archives are laminated). Synchronizing the ^{10}Be records from Western Gotland Basin and Lake Kälksjön sediments to the precise ^{14}C time-scale allows us to reduce the existing centennial-scale chronological uncertainties between both archives to a few decades. Such improved chronological constraints will enable us the investigation of possible environmental gradients and thresholds in the Baltic ecosystem, as well as their forcing mechanisms, at improved temporal precision. Our results further point to the importance of stratified conditions (with laminated sediments) in the Western Gotland Basin for preserving high-resolution ^{10}Be production rate changes through reduced lateral sediment transport and bioturbation.

References

BACC II, 2015. Second assessment of climate change for the Baltic Sea basin. Springer, Heidelberg. https://doi.org/10.1007/978-3-319-16006-1

Czymzik, M., Nowaczyk, N.R., Dellwig, O., Wegwerth, A., Muscheler, R., Christl, M., Arz, H.W., 2020. Lagged atmospheric circulation response in the Black Sea region to Greenland Interstadial 10. Proc. Natl. Acad. Sci. U. S. A. 117, 28649–28654. https://doi.org/10.1073/pnas.2005520117

Reimer, P.J., Austin, W.E.N., Bard, E., Bayliss, A., Blackwell, P.G., Bronk Ramsey, C., Butzin, M., Cheng, H., Edwards, R.L., Friedrich, M., Grootes, P.M., Guilderson, T.P., Hajdas, I., Heaton, T.J., Hogg, A.G., Hughen, K.A., Kromer, B., Manning, S.W., Muscheler, R., Palmer, J.G., Pearson, C., van der Plicht, J., Reimer, R.W., Richards, D.A., Scott, E.M., Southon, J.R., Turney, C.S.M., Wacker, L., Adolphi, F., Büntgen, U., Capano, M., Fahrni, S.M., Fogtmann-Schulz, A., Friedrich, R., Köhler, P., Kudsk, S., Miyake, F., Olsen, J., Reinig, F., Sakamoto, M., Sookdeo, A., Talamo, S., 2020. The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal BP). Radiocarbon 62, 725–757. https://doi.org/10.1017/rdc.2020.41

Session 3 – Synchronisation and Dating of Proxy Records

The cryptotephra revolution: connecting, correlating and constraining chronologies

Davies, Siwan M.*

Department of Geography, Swansea University, Wales, UK
* Corresponding author: siwan.davies@swansea.ac.uk

Little did we expect that a scant sprinkling of volcanic ash grains over past land surfaces in areas far removed from source would have such an impact on Quaternary research. Although the earliest application of tephrochronology can be traced to nearly a hundred years ago, the more recent quest for cryptotephras has given rise to a powerful tool to precisely correlate proxy records and address a range of pressing scientific questions relating to the past. In particular, tracing independent marker horizons across a range of disparate palaeoarchives has huge potential to provide unprecedented insights into the spatiotemporal variability of abrupt climate changes, volcano-climate interactions, as well as the global record of volcanism. Over recent years, bespoke extraction and analytical techniques have sparked many new and exciting discoveries of cryptotephras in key palaeoclimatic archives from the ice, marine and terrestrial realms. Typically, each cryptotephra discovery is accompanied by a robust geochemical signature and age estimate which form the backbone of regional tephrochronological frameworks. These frameworks have become the building blocks for the successful application of cryptotephrochronology. But how do these building blocks fit together to connect geoarchives? I will synthesise the historical advances, the successful achievements as well as the challenges and future directions of applying this technique to connect, correlate and constrain Quaternary chronologies.

Session 5 – Earth Surface Processes and Environmental Change

Non-climatic drivers of ice marginal shifts arising from the interplay of regional ice dynamics: A discussion in relation to moraines of the Southern Sector Scandinavian Ice Sheet

Diemont, Christiaan [1*]; Clark, Chris[1]; Livingstone, Stephen[1]; Bradley, Sarah[1] & Hughes, Anna[2]

[1] Department of Geography, University of Sheffield, United Kingdom
[2] School of Environment, Education and Development, University of Manchester, United Kingdom
[*] Corresponding author: crdiemont1@sheffield.ac.uk

Moraines, fans and other ice marginal landforms and sediments provide robust indicators of changing ice sheet extent through time, and are often compared with or used as climate proxies. A problem with such inferences of ice extent varying solely or primarily with climate is that once we obtain improved dating control on margins we often find non-monotonic ice sheet behavior (ice marginal oscillations) and asynchronous nature of maximum extents in different sectors. In this talk we discuss the issue of non-climatic controls on ice margin changes of the Scandinavian Ice Sheet (SIS), noting the importance of the interplay of regional ice dynamics and we start the reconciliation of climatic and non-climatic controls in modulating the changing ice sheet extent. The dynamics of the Scandinavian Ice Sheet (SIS) have predominantly been investigated using local to regional geomorphic and sedimentological evidence, building a series of reconstructions around the ice sheet perimeter. To address larger scale ice dynamic interactions requires the complex nature of the evidence to be deciphered at an ice sheet scale. Making use of a suite of digital elevation models we are developing a consistent landform-driven ice sheet reconstruction of the soft bedded Southern and Eastern sectors of the SIS (from Denmark to Kola, Russia). This first order reconstruction may assist in integrating detailed local investigations in the study area. Initial reconstruction efforts point to a range of non-climatic factors driving the behavior of the SIS in the Southern Sector. The confluence and build-up of an ice divide between the British-Irish and the Scandinavian ice sheets likely resulted in a shutdown of Swedish ice evacuation into the North Sea, resulting in enhanced southward ice flux to Germany and Poland. Subsequent collapse of the confluence reactivated North Sea ice evacuation, starving the southern margin of ice. We hypothesize that such a model is key for understanding the retreat and reconfiguration of ice extent and flow directions in Germany, Denmark and Poland. Other possible controls on dynamics including glacio-isostatic effects on steering ice in the Southern Sector are also discussed.

Session 1 – Climate variability and warmer climates

Towards quantitative fire-vegetation-climate feedbacks: linking sedimentary fire proxy composition of interglacial Lake El'gygytgyn with modern lake sediments

Dietze, Elisabeth[1,2,3*]; Andreev, A.[1,3]; Mangelsdorf, K.[2]; Reichel, V.[1]; Tessendorf, T.[1]; Weise; J.[1], Lisovski, S.[1] & Herzschuh, U.[1,4,5]

[1] Alfred-Wegener-Institut for Polar and Marine Science, Polar Terrestrial Environmental Systems, Potsdam, Germany
[2] German Research Center for Geoscience (GFZ), Organic Geochemistry, Potsdam, Germany
[3] now at: University of Göttingen, Institute of Geography, Landscape Geoscience, Göttingen, Germany
[4] University of Potsdam, Institute of Environmental Sciences and Geography, Potsdam-Golm, Germany
[5] University of Potsdam, Institute of Biochemistry and Biology, Potsdam-Golm, Germany
* Corresponding author: elisabeth.dietze@geo.uni-goettingen.de

The ongoing intensification of forest fires in the Arctic (more burned area, longer fire season, higher fire intensities) raises concerns if these fires might lead to biome shifts from tundra to summergreen or evergreen boreal forest – with consequences for regional to global biophysical land properties and biogeochemical cycles. Given the short time span of instrumental observations, it is unknown if fire can initiate or support biome shifts under the ongoing amplified warming or if climate drives fire regime and biome changes

independently. Lake El’gygytgyn in the Russian Far East is currently surrounded by tundra, but during late marine isotope stage (MIS) 12 and “superinterglacial” MIS 11, c. 375-440 kyrs ago, pollen data suggests that biome composition changed several times, from a glacial steppe to interglacial summergreen and evergreen boreal forest (Melles et al., 2012). Here, we investigate if and which type of fire regime shifts accompanied these biome shifts.

To enable a quantitative reconstruction of changes in fire intensities and the type of biomass burnt, we analyzed multiple fire proxies in interglacial and modern lake sediments, their amounts (influx) and their composition (ratios). The monosaccharide anhydrides (MAs) are biomass burning residues from low-temperature fires analyzed with ultra-high-performance liquid chromatography coupled to a high-resolution mass spectrometer. Sedimentary charcoal reflects mid-to-high intensity fires and was analyzed in the sieved fraction > 150 μm and from pollen slides using classical microscopy. MA isomer ratios and charcoal morphotypes were used to reconstruct the type of biomass burnt. We established links between fire proxy and pollen-based vegetation composition for MIS 11 using sediments from El’gygytgyns ICDP sediment core 5011-1A, including data from Dietze et al. (2020).

To link fire proxy composition with fire regime properties, we analyzed the same fire proxies in modern lake surface sediments from three lakes in Eastern Siberia as a space-for-time analogue. Then, we assessed modern charcoal source areas by simulating charcoal transport following Vachula and Richter (2018) using data from modern fires, i.e. fire radiative power from the MODIS Thermal Anomalies product, and wind fields from ERA5 climate data (see conceptual model in Fig. 1).

We find clear differences in sedimentary fire proxy composition depending on source area of charcoals and MAs in modern lake sediments. Modern types of fire regime-fire proxy-vegetation-relationships are linkable to past interglacial relationships indicating that fire regime change played a role during some, but not all interglacial biome shifts. Overall, we provide new understanding of Siberian sedimentary fire proxies, crucial for a sound, i.e. quantitative reconstruction of long-term fire regime change, allowing to assess the role of fire regime intensification in biome changes during periods of stark warming.

The study was funded by DFG grants DI 2544/1-1 & 1-2 to ED and ERC grant “Glacial Legacy” to UH.

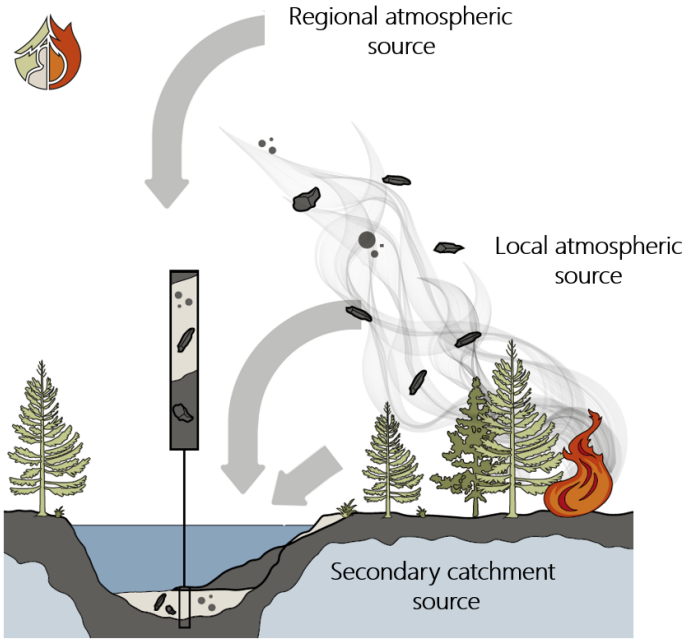

Fig. 1: *Conceptual model of fire proxy (charcoal and molecular markers) sources and transport pathways that need to be considered in long-term quantitative fire regime reconstructions in Eastern Siberia (sketch: E. Dietze & D. Post, 2021).*

References

Dietze, E., Mangelsdorf, K., Andreev, A., Karger, C., Schreuder, L.T., Hopmans, E.C., Rach, O., Sachse, D., Wennrich, V., Herzschuh, U., 2020. Relationships between low-temperature fires, climate and vegetation during three late glacials and interglacials of the last 430 kyr in northeastern Siberia reconstructed from monosaccharide anhydrides in Lake El'gygytgyn sediments. Clim. Past 16, 799-818.

Melles, M., Brigham-Grette, J., Minyuk, P.S., Nowaczyk, N.R., Wennrich, V., DeConto, R.M., Anderson, P.M., Andreev, A.A., Coletti, A., Cook, T.L., Haltia-Hovi, E., Kukkonen, M., Lozhkin, A.V., Rosén, P., Tarasov, P., Vogel, H., Wagner, B., 2012. 2.8 Million Years of Arctic Climate Change from Lake El’gygytgyn, NE Russia. Science 337, 315-320.

Vachula, R.S., Richter, N., 2018. Informing sedimentary charcoal-based fire reconstructions with a kinematic transport model. The Holocene 28, 173-178.

Session 3 – Synchronisation and Dating of Proxy Records

Going virtual: testing our proxy archive assumptions by creating and sampling virtual sediment sections with the R package 'sandbox'

Dietze, Michael[1,2*]; Kreutzer, Sebastian[3]; Fuchs, Margret C. [4] & Meszner, Sascha[5]

[1] Georg-August-Universität Göttingen, Faculty of Geosciences and Geography, Göttingen, Germany
[2] GFZ Potsdam, Section 4.6 Geomorphology, Potsdam, Germany
[3] Geography & Earth Sciences, Aberystwyth University, Aberystwyth, Wales, United Kingdom
[4] Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz-Institute Freiberg for Resource Technology, Freiberg, Germany
[5] JENA-GEOS-Ingenieurbüro GmbH, Jena, Germany
* Corresponding author: michael.dietze@uni-goettingen.de

Past environmental information is typically inferred from proxy data contained in accretionary sediments. The validity of proxy data and analysis workflows are usually assumed implicitly, with systematic tests and uncertainty estimates restricted to modern analogue studies or reduced-complexity case studies. However, a more generic and consistent approach to exploring the validity and variability of proxy functions would be to translate a sediment section into a model scenario: a "virtual twin". Here, we introduce a conceptual framework and numerical tool set that allows the definition and analysis of synthetic sediment sections. The R package sandbox describes arbitrary stratigraphically consistent deposits by depth-dependent rules and grain-specific parameters, allowing full scalability and flexibility. Virtual samples can be taken, resulting in discrete grain-mixtures with defined parameters. These samples can be virtually prepared and analysed, for example to test hypotheses. We illustrate the concept of sandbox, explain how a sediment section can be mapped into the model and explore geochronological research questions related to the effects of sample geometry and grain-size specific age inheritance. We summarise further application scenarios of the model framework, relevant for but not restricted to the broader geochronological community.

Session 5 – Earth Surface Processes and Environmental Change

Earthworms, Darwin and prehistoric agriculture-Chernozem genesis reconsidered

Dreibrodt, Stefan[1*]

[1] University of Kiel, CRC1266/Institute for Ecosystem Research, Germany
* Corresponding author: sdreibrodt@ecology.uni-kiel.de

Chernozems and chernozem-like soil (Mollisols) cover c. 7% of the Earth surface (Eurasia, North and South America), provide an important terrestrial carbon reservoir and are among the most fertile agricultural soils. Anecic earthworm surface casting is the main process explaining Chernozem genesis, properties and distribution across Eurasia. This has implications for Chernozems as geoarchives, for long-term carbon sequestering, sustainable management and protection of this valuable resource. Whereas under climatic steppe conditions epigeic and endogeic earthworm species are limited naturally, favouring conditions for anecic earthworms have been created in humid temperate landscapes by early anthropogenic activities (forest clearings, non-industrial agriculture). Thus, provocatively, anecic earthworms were added to the “Neolithic package” (Dreibrodt et al., 2022).

The occurrence of Chernozems in humid temperate parts of Europe along the transect of Neolithic transition makes this soil type a geoarchive of Anthropocene continent scale landscape transformation comparable to other geoarchives of Holocene human impact (slope wash, lake sediments, pollen archives).

The new hypothesis of Chernozem genesis is outlined using results from central Ukraine and Germany. Prospects of investigations on Chernozems and possible implications are discussed.

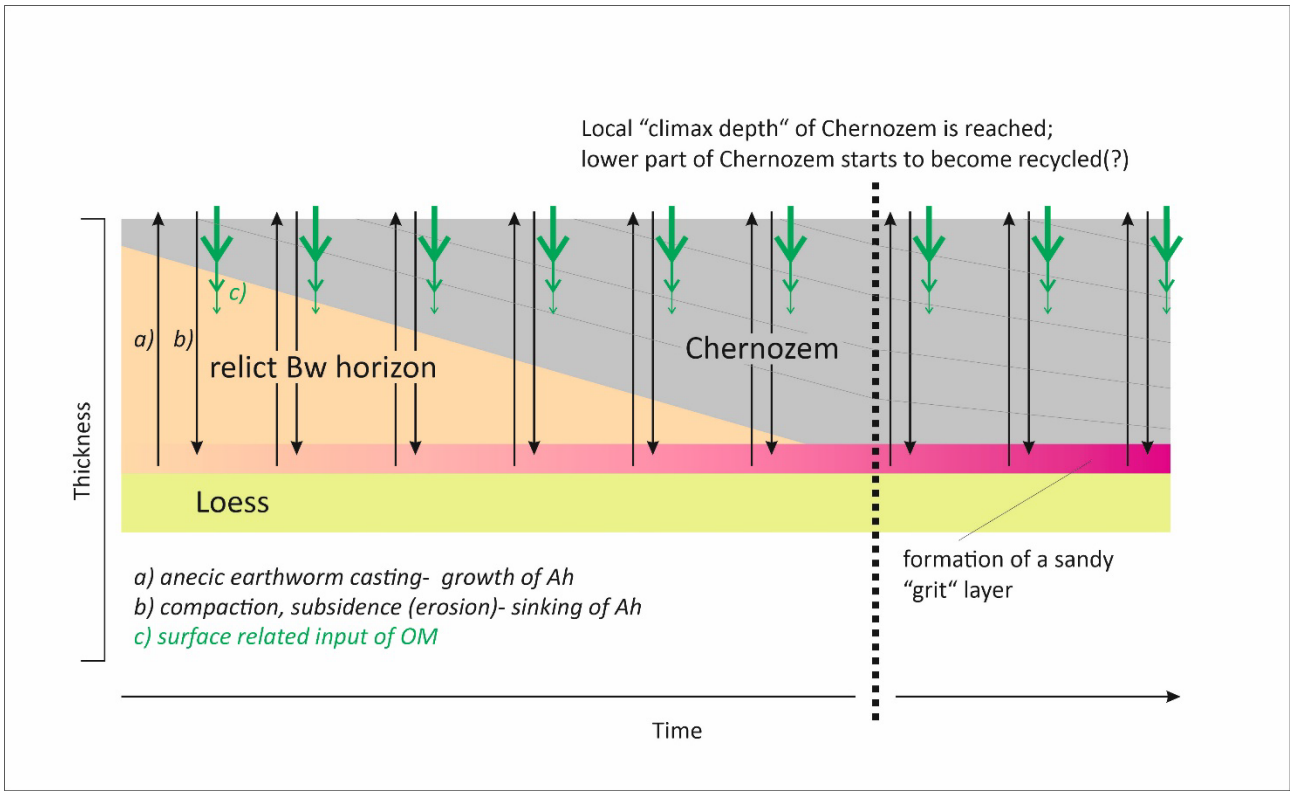

Fig. 1: *Simplified scheme of Chernozem formation by anecic earthworm surface casting in a former (“buried”) incipient Cambisol (Dreibrodt et al., 2022)*

References

Dreibrodt, S. et al., 2022. Earthworms, Darwin and prehistoric agriculture- Chernozem genesis reconsidered. Geoderma 409, 115607.

Session 3 – Synchronisation and Dating of Proxy Records

Revisiting the geochronology of a drill-core in the glacially overdeepened basin underneath Neusillerdorf, near Freilassing Bavaria using single grain feldspar luminescence dating

Firla, Gustav[1*]; Lüthgens, Christopher[1]; Schmalfuß, Clemens[1]; Neuhuber, Stephanie[1] & Fiebig, Markus[1]

[1] University of Natural Resources and Life Sciences, Vienna, Department of Civil Engineering and Natural Hazards, Institute of Applied Geology
* Corresponding author: gustav.firla@boku.ac.at

Glacially overdeepened basins are subterranean structures incised into the underlying bedrock by glaciers and filled with eroded material from the adjacent landscape. The fill of overdeepened structures potentially stores vast amounts of sediments and can therefore serve as a sedimentary archive. This investigation is part of the multinational pan-alpine ICDP - DOVE (International Continental Scientific Drilling Program - Drilling Overdeepened Alpine Valleys) research project, which set out to analyse and compare overdeepenings around the northern part of the Alps. One of the investigated overdeepened basins is located west of Freilassing, Bavaria under the former lobe of the Salzach foreland glacier. A 136 m long core (ICDP-5068_4), drilled near Neusillersdorf consists of 117 m of Quaternary sediments on top of 19 m of bedrock. The Quaternary sediments can be further divided into a base diamicton overlain by fine-sand/silt sized laminated sediments that are covered by sandy-gravel/diamicton sediments. Previous luminescence measurements by Fiebig et al. (2014) yielded reliable ages above 23 m, but below that only minimum ages could be obtained, because of signal saturation of the multi grain feldspar aliquots. New single-grain feldspar luminescence ages add a new temporal perspective to the drill-core. We present first postIRIR225 ages, based on the approach of Rades et al. (2018) over the whole depth of the Quaternary sediments and discuss the new ages and their methodological implications in the context of the Fiebig et al. (2014) study.

References

Fiebig, M., Herbst, P., Drescher-Schneider R., Lüthgens, C., Lomax, J., Doppler G., 2014.Some remarks about a new Last Glacial record from the western Salzach foreland glacier basin (Southern Germany). Quaternary International 328-329 (2014), 107–119.

Rades, E. F., Fiebig, M., Lüthgens, C., 2018. Luminescence dating of the Rissian type section in southern Germany as a base for correlation. Quaternary International 478 (2018), 38-50.

Session 1 – Climate variability and warmer climates

Millennial to centennial scale terrestrial ecosystem responses to Upper Pleistocene North Atlantic climatic oscillations in Central Europe

Fischer, Peter[1*]; Prud’homme, Charlotte[2]; Jöris, Olaf[3]; Hatté, Christine[4,5]; Vinnepand, Mathias[1]; Moine, Olivier[6]; Fitzsimmons, Kathryn E.[7] & Vött, Andreas[1]

[1] Johannes Gutenberg University Mainz, Institute of Geography, Mainz, Germany
[2] Université de Lausanne, Institute of Earth Surface Dynamics, Faculty of Geosciences and the Environment, Lausanne, Switzerland
[3] MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, Neuwied, Germany
[4] Université Paris-Saclay, Laboratoire des Sciences du Climat et de l’Environnement, Gif-sur-Yvette, France
[5] Silesian University of Technology, Institute of Physics, Gliwice, Poland
[6] Université Paris, Laboratoire de Géographie Physique: Environnements Quaternaires et Actuels, Meudon, France
[7] University of Tübingen, Department of Geosciences, Tübingen, Germany
***** Corresponding author: p.fischer@geo.uni-mainz.de

Over the Last Glacial period, North Atlantic climate has been characterised by abrupt millennial to centennial scale oscillations, known as Dansgaard-Oeschger (D-O) events. The propagation and impact of these climate events onto the European continent is still not fully understood, as terrestrial archives often lack precise and independent age models as well as quantitative climate data.

Loess-Palaeosol-Sequences (LPS) in Central Europe often record these climatic changes in the form of brown soils and tundra gley horizons - indicating milder interstadial conditions - alternating with primary loess deposits reflecting cold stadial conditions. Fossil earthworm calcite granules (ECGs) secreted by the species *Lumbricus* provide an invaluable record of palaeoecological response to these short-term climatic variations, since they are secreted within the same layer as the accumulating sediment. Variability in the abundance of ECGs, as well as their stable isotope chemistry, can be used as proxies for warm-season land-surface temperatures (LSTws) and mean annual precipitation (MAP); in addition, the crystalline calcite can be reliably dated using radiocarbon to high precision.

In this contribution we focus on the Schwalbenberg LPS in the western German Rhineland, which provides a unique, high-resolution record for part of the last glacial period from c. 50,000 to 20,000 cal BP based on radiocarbon dating of ECGs, which facilitates precise correlations with other climate archives over this time interval. ECG isotopic geochemistry is used to quantify LSTws and MAP values over this period, so providing a quantitative terrestrial counterpart to marine and ice-core derived reconstructions for North Atlantic climate influence on the region. ECG counts down the profile reveal millennial-scale climatic variations, with high ECG concentrations in pedogenetically altered horizons indicating milder climate conditions with relatively increased biological activity and denser vegetation cover. We find that climate signals at Schwalbenberg are coeval with other regional to global records for the Upper Pleistocene, but that the amplitude of climate signals varies significantly.

Our approach represents a useful combination of high-resolution age modelling and geochemical proxy-based climate reconstruction which can be readily adopted at other LPS. A more widespread implementation of this approach would provide an improved understanding of regional variability in North Atlantic climate propagation onto the European continent over millennial to centennial timescales.

Session 5 – Earth Surface Processes and Environmental Change

Sedimentary controls on runoff-generated debris flow frequency

Francis, Oliver[1*]; Tang, Hui[1] & Turowski, Jens[2]

[1] Section 4.7 Earth Surface Process Modelling, Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany
[2] Section 4.6 Geomorphology, Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany
* Corresponding author: oliver.francis@gfz-potsdam.de

The stratigraphy of sedimentary system deposits is commonly used as a proxy for understanding past climate change. In mountainous regions, changes in the sedimentary system are primarily recorded in the morphology and stratigraphy of alluvial deposits. These deposits, in particular alluvial fans, are rapidly forming and can store information on sediment production and transport at high resolutions (glacial – interglacial cycles) making them excellent candidates for understanding past climatic events. The stratigraphy of alluvial fans is formed of stacked stream and debris flow deposits, the relative abundances and composition of which can be related to rates of sediment production and transport. Interpreting these records to derive climatic information requires a deep understanding of how climate controls the production, transport, and deposition of sediment in the catchment. In this study, we focus on how climate change may influence runoff and debris flow generation and their potential impact on alluvial fan geometry and stratigraphy.

In small steep rocky catchments runoff is generated if the rainfall is intense enough to overcome the initial abstraction of the catchment. If the runoff generated is great enough, and there is a significant volume of sediment in the catchment, a debris flow can be formed. Debris flow frequency is, therefore, a function of the return period of intense rainstorms and the properties (volume, distribution, grain size, and hydraulic conductivity) of the sediment. Combining knowledge of the triggering conditions of debris flows with rainfall statistics will provide us with a framework to interpret climate change from the stratigraphy of alluvial fan deposits. By defining a physically-based rainfall Intensity-Duration (ID) threshold for debris flow initiation, we can determine how the source sediment can affect debris flow frequency. Using a numerical model, we determine a physically constrained rainfall intensity threshold for the catchment. We can then combine this threshold with rainfall statistics and simulations of source sediment conditions to determine debris flow frequency in various scenarios. We use the SWEHR model developed by McGuire et al., 2016 to simulate debris flows in a simple catchment in the Italian dolomites. This model combines the Green-Ampt infiltration model, the Hairsine Rose soil erosion model, and the shallow water equations to simulate the runoff and erosion response to a rain storm in a given catchment. We calibrate the model on a known debris flow triggering storm and use this to determine a critical stress threshold for debris flow initiation. Experiments varying the thickness, distribution, and hydraulic conductivity of the sediment show that small changes in the source sediment can result in significant variation in debris flow frequency (figure). Therefore, inversions of alluvial fan stratigraphy must consider source sediment variation to produce accurate climate records.

References

McGuire, L. A., Kean, J. W., Staley, D. M., Rengers, F. K., & Wasklewicz, T. A. (2016). Constraining the relative importance of raindrop- and flow-driven sediment transport mechanisms in postwildfire environments and implications for recovery time scales. Journal of Geophysical Research: Earth Surface, 121(11), 2211–2237. https://doi.org/10.1002/2016JF003867

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Climatic and antrophogenic impacts recorded by diatoms from Holocene sediments of Holzmaar, Germany

García, M. Luján1*; Birlo, Stella[1] & Zolitschka, Bernd[1]

[1] University of Bremen, Institute of Geography, GEOPOLAR, Germany
* Corresponding author: garcia@uni-bremen.de

Paleoclimatic reconstructions help to understand how ecosystems change through space and time. The complexity of climate–ecosystem linkages, however, makes it difficult to decipher a distinct climatic signal in the sediment record from other environmental (anthropogenic) responses especially during the last millennia (Zolitschka et al., 2002). Lacustrine environmental archives with annually laminated (varved) sediments permit a calendar-year chronology and allow calculation of precise sediment accumulation rates. Diatoms are one of the most widely used biological proxy for lacustrine records with their species composition being related to climate variability and anthropogenic impact (Smol, 2017).

For our study, we performed multiproxy analyses of annually laminated sediments from Holzmaar (West-Eifel Volcanic Field, Germany). We obtained four parallel profiles comprising a composite record (HZM19) of 14.5 m length that covers the last 16,000 years. Here, we present results for the last 7000 years to track climatic changes and human impact from the Middle Holocene until present-day with the aim to identify the most interesting sections for future high-resolution analyses. In addition to diatoms, we analysed magnetic susceptibility (MS) and the elemental composition including biogenic silica.

During the Middle Holocene (~6000 cal BP), the decrease and disappearance of warmth-indicating diatom taxa, such as *Lindavia radiosa* and *Nitzschia paleaceae*, document the end of the Holocene Climatic Optimum. The shift in diatom communities, with *Asterionella formosa* and *Pantosekiella ocellata* dominating, suggests oligotrophic conditions and thermal stability. The peak of *A. formosa* indicating higher nitrogen concentrations might be related to Neolithic anthropogenic disturbances. The replacement of *P. ocellata* by *Stephanodiscus minutulus* marks the transition between the Middle and the Late Holocene (~4200 cal BP), a switch to eutrophic conditions with more intense watercolumn mixing, probably related to higher wind intensity. Accompaning the diatom community change, higher values of titanium and MS reflect an increase in surface runoff due to higher humidity, enhanced by human settlements in the catchment area of the lake.

The last 2200 years of HZM19 represent a marked shift of the diatom community to cyclotelloid taxa (*L. radiosa* and *Pantosekiella comensis*) indicating warmer conditions and thermal stability (Rühland et al., 2015). The increasing abundance of *L. radiosa* during this upper part of the record and warmer conditions also refer to a marked change in the catchment vegetation. The shift between *L. radiosa* and *P. comensis* might be also related to changes of the light regime. Clear lake water would favour *L. radiosa*, i.e. during the Migration Period, while a low light regime, which is related to higher turbidity caused by higher minerogenic influx, would benefit *P. comensis,* i.e. during the Roman Period and the Middle Ages. The appearance of *Aulacoseira* aff. *subarctica* between 630 and 170 cal BP is related to the Little Ice Age as this species flourishes in turbulent waters due to its high density and characterizes cool conditions without thermal stratification. During this period, cyclotelloid taxa show a decreasing trend. However, the nutrient enrichment associated with anthropogenic disturbances maintains this species association until modern days.

The Holzmaar sediment record has a large potential for inferring past environmental changes. Application of diatom analyses in combination with geochemical proxies in much higher temporal resolution will be a key to better understand short-term variability of limnological conditions and to gain a more complete understanding of changes in aquatic ecosystems in relation to natural climatic and anthropogenic processes.

References

Rühland, K. M., Paterson, A. M. & Smol, J. P. 2015. Lake diatom responses to warming: reviewing the evidence. J. Paleolimnol., 54(1), 1–35. https://doi.org/10.1007/s10933-015-9837-3

Smol, J.P. 2017. Paleolimnology, Reference Module in Earth Systems and Environmental Sciences, Elsevier.

Zolitschka, B., Mingram, J., Van Der Gaast, S., Jansen, J. H. F. & Naumann, R. 2002. Sediment Logging Techniques, in W. M. Last & J. P. Smol (Eds.), Tracking Environmental Change Using Lake Sediments Vol. 1. Springer Netherlands, pp. 137–153. https://doi.org/10.1007/0-306-47669-X_7

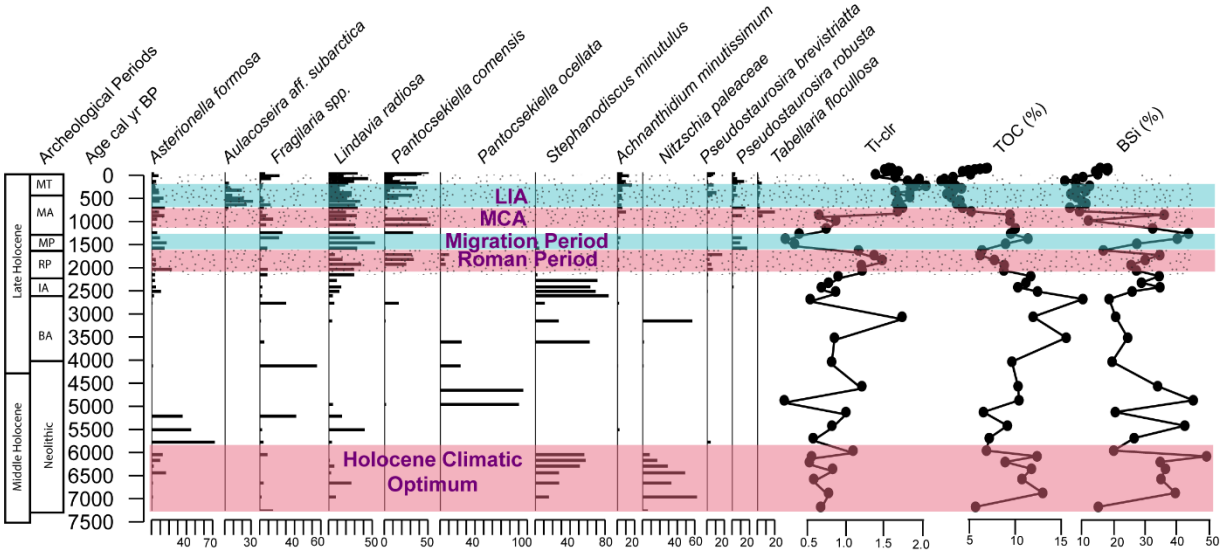

Fig. 1: *Summary diagram of Middle to Late Holocene environmental conditions at Holzmaar. Shown are archaeological periods together with dominant diatom species, clr-transformed titanium (Ti-clr) as a proxy for minerogenic influx, total organic carbon (TOC) as a proxy for lacustrine productivity and biogenic silica (BSi) as a proxy for diatoms. Prominent climatic intervals are shaded (blueish for colder and reddish for warmer periods) and labelled as Holocene Thermal Maximum, Roman Period, Migration Period, Medieval Climate Anomaly (MCA) and Little Ice Age (LIA). Periods with increased soil erosion (Roman Period and since the MCA) are marked by a dotted signature.*

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Einblicke in die Vergangenheit: neue pleistozäne Profile aus dem Oberrheingraben

Gegg, Lukas[1*]; Griebling, Felicitas[1]; Jacob, Laura[1]; Jentz, Nicole[1]; Schwahn, Fiona[1]; Stark, Lena[2]; Wielandt-Schuster, Ulrike[2] & Preusser, Frank[1]

[1] Institut für Geo- und Umweltnaturwissenschaften, Universität Freiburg
[2] Landesamt für Geologie, Rohstoffe und Bergbau (LGRB), Freiburg
* Kontakt: lukas.gegg@geologie.uni-freiburg.de

Sedimentabfolgen, die Spuren vergangener Umweltbedingungen, von Flora und Fauna, sowie von landschaftsformenden Prozessen enthalten, sind einer der Schlüssel zum Verständnis und zur Bezifferung von Klima- und Umweltwandel. Allerdings ist das Erhaltungspotenzial von Ablagerungen auf dem Festland häufig gering, was zu einem nur lückenhaften Muster von Sedimentabfolgen führt, und detaillierte Rekonstruktionen erschwert. Umso bedeutender sind regional-maßstäbliche Becken, die lange – in Zeit und Raum – Sedimentabfolgen beherbergen

Ein solches Becken ist der Oberrheingraben (ORG), ein tektonisches Riftbecken, das sich über mehr als 300 km von Basel im Süden bis Frankfurt am Main im Norden erstreckt. Die Absenkung des ORG begann bereits im Paläogen, und so enthält er eine kilometerdicke Sedimentfüllung, von der alleine das Quartär lokal Mächtigkeiten von rund 500 m erreicht. Gespeist durch den Rhein und seine Zuflüsse, fängt der ORG Sedimente aus den Alpen und dem Schweizer Jura, aber auch von den Grabenschultern, vor allem der französischen Vogesen und des Schwarzwalds, auf.

Wir stellen die Pleistozäne Sedimentfüllung des ORG anhand von Bohrkernen vor, die ein 175 km langes Transekt vom Ausgang der Freiburger Bucht, über Offenburg und Karlsruhe, bis in das Heidelberger Loch aufspannen. Die einzelnen Abfolgen sind ausgesprochen abwechslungsreich und beinhalten (glazi-)fluviale Schotter und Sande, feinkörnige Stillwassersedimente und Lösse sowie diamiktische Ablagerungen. Im Detail untersucht, eröffnen sie spannende neue Einblicke in die Vergangenheit.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Anwendung der Infrarot-Radiofluoreszenz-Datierungsmethode (IR-RF) am Bohrkern von Riedstadt-Erfelden zur Erstellung einer Chronologie des nördlichen Oberrheingrabens

Geis, Anna-Lena[1*]; Sontag-González, Mariana[1]; Hoselmann, Christian[2] & Fuchs, Markus[1]

[1] Justus-Liebig-Universität Gießen, Institut für Geographie, Gießen, Deutschland
[2] Hessisches Landesamt für Naturschutz, Umwelt und Geologie, Wiesbaden, Deutschland
[*] Kontakt: Anna.L.Geis@geogr.uni-giessen.de

Der Oberrheingraben (ORG), der sich über 300 km von Basel in der Schweiz, bis Frankfurt in Deutschland, erstreckt, enthält eine der mächtigsten und kontinuierlichsten Abfolgen pleistozäner und pliozäner Sedimente in Mitteleuropa. Daher ist seine Untersuchung von größter Bedeutung, um die treibenden Faktoren hinter den Sedimentations- und Erosionsprozessen des Rhein-Systems sowie die geologische Entwicklung des Grabensystems während des Quartärs und darüber hinaus zu verstehen. In den Jahren 2020/21 wurde vom Hessischen Landesamt für Naturschutz, Umwelt und Geologie (HLNUG) ein neues Bohrprojekt in Riedstadt-Erfelden, Hessen, durchgeführt, um weitere Informationen über die Entwicklung des nördlichen Teils des ORG und seiner sedimentären Verfüllungen zu erhalten. Dabei wurden Sedimentkerne bis in 323 m Tiefe gewonnen. Der neue Kern ergänzt frühere Bohrungen in Viernheim, Heidelberg, Ludwigshafen und Kronau (Gabriel et al., 2013; Preusser et al., 2021). Während die ersten Bohrungen bereits beschrieben und analysiert wurden (z. B. Lauer et al., 2010; Lauer et al., 2011, Li et al., 2018), laufen derzeit mehrere Untersuchungen am Riedstädter Kern, einschließlich numerischer Datierungen. Die vorliegende Arbeit zielt darauf ab, die litho- und chronostratigraphischen Informationen durch die Anwendung von Lumineszenz-Datierungsmethoden auf den oberen Abschnitt des Riedstädter Kerns zu ergänzen. Wir präsentieren erste Ergebnisse der Infrarot-Radiofluoreszenz-Datierung (IR-RF) von K-Feldspat, einer Technik, die nicht unter der Signalinstabilität leidet, die bei anderen Lumineszenz-Datierungsmethoden für dieses Mineral auftritt (z.B. Murari et al., 2021). Außerdem geben wir einen Ausblick auf die geplante Anwendung weiterer Methoden, die zur Verbesserung der Chronologie des nördlichen ORG beitragen können.

Literatur

Gabriel, G., Ellwanger, D., Hoselmann, C., Weidenfeller, M., Wielandt-Schuster, U., 2013. The Heidelberg Basin, Upper Rhine Graben (Germany): a unique archive of Quaternary sediments in Central Europe. Quaternary International. 292 ,43–58. DOI: 10.1016/j.quaint.2012.10.044

Lauer, T., Frechen, M., Hoselmann, C., Tsukamoto, S., 2010. Fluvial aggradation phases in the Upper Rhine Graben – New insights by quartz OSL dating. Proceedings of the Geologists’ Association. 121/2, 154–161. DOI: 10.1016/j.pgeola.2009.10.006

Lauer, T., Krbetschek, M. R., Frechen, M., Tsukamoto, S., Hoselmann, C., Weidenfeller, M., 2011. Infrared Radiofluorescence (IR-RF) dating of Middle Pleistocene fluvial archives of the Heidelberg Basin (Southwest Germany). Geochronometria. 38, 23–33. DOI: 10.2478/s13386-011-0006-9

Li, Y., Tsukamoto, S., Frechen, M., Gabriel, G., 2018. Timing of fluvial sedimentation in the Upper Rhine Graben since the Middle Pleistocene: constraints from quartz and feldspar luminescence dating. Boreas. 47, 256–270. DOI: 10.1111/bor.12266

Murari, M.K., Kreutzer, S., King, G., Frouin, M., Tsukamoto, S., Schmidt, C., Lauer, T., Klasen, N., Richter, D., Friedrich, J., Mercier, N., Fuchs, M., 2021. Infrared radiofluorescence (IR-RF) dating: A review. Quaternary Geochronology. 64, 101155. DOI: 10.1016/j.quageo.2021.10115.

Preusser, F., Büschelberger, M., Kemna, H. A., Miocic, J., Mueller, D., May, J.-H., 2021. Exploring possible links between Quaternary aggradation in the Upper Rhine Graben and the glaciation history of northern Switzerland. International Journal of Earth Sciences. 110, 1827–1846. DOI: 10.1007/s00531-021-02043-7

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Holocene wildfire and vegetation dynamics in Central Yakutia, Siberia, reconstructed from lake-sediment proxies

Glückler, Ramesh[1,4*]; Geng, Rongwei[1,2,3]; Grimm, Lennart[1]; Baisheva, Izabella[1,4,6]; Herzschuh, Ulrike[1,4,5]; Stoof-Leichsenring, Kathleen[1]; Kruse, Stefan[1]; Andreev, Andrei[1]; Pestryakova, Luidmila[6] & Dietze, Elisabeth[1,7]

[1] Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Polar Terrestrial Environmental Systems, Potsdam, Germany
[2] Chinese Academy of Sciences, Institute of Geographical Sciences and Natural Resources Research, Key Laboratory of Land Surface Pattern and Simulation, Beijing, China
[3] University of Chinese Academy of Sciences, Beijing, China
[4] University of Potsdam, Institute for Environmental Science and Geography, Potsdam, Germany
[5] University of Potsdam, Institute for Biochemistry and Biology, Potsdam, Germany
[6] North-Eastern Federal University of Yakutsk, Institute of Natural Sciences, Yakutsk, Russia
[7] GFZ German Research Centre for Geoscience, section Organic Geochemistry, Potsdam, Germany
* Corresponding author: ramesh.glueckler@awi.de

Wildfires play an essential role in the ecology of boreal forests. In eastern Siberia, fire activity has been increasing in recent years, challenging the livelihoods of local communities. Intensifying fire regimes also increase disturbance pressure on the boreal forests, which currently protect the permafrost beneath from accelerated degradation. However, long-term relationships between changes in fire regime and forest structure remain largely unknown. We assess past fire-vegetation feedbacks using sedimentary proxy records from Lake Satagay, Central Yakutia, Siberia, covering the past c. 10,800 years. Results from macroscopic and microscopic charcoal analyses indicate high amounts of burnt biomass during the Early Holocene, and that the present-day, low-severity surface fire regime has been in place since c. 4500 years before present. A pollen-based quantitative reconstruction of vegetation cover and a terrestrial plant record based on sedimentary ancient DNA metabarcoding suggest a pronounced shift in forest structure towards the Late Holocene. Whereas the Early Holocene was characterized by postglacial open larch-birch woodlands, forest structure changed towards the modern, mixed larch-dominated closed-canopy forest during the Mid-Holocene. We propose a potential relationship between open woodlands and high amounts of burnt biomass, as well as a mediating effect of dense larch forest on the climate-driven intensification of fire regimes. Considering the anticipated increase in forest disturbances (droughts, insect invasions, wildfires), higher tree mortality may force the modern state of the forest to shift towards an open woodland state comparable to the Early Holocene. Such a shift in forest structure may result in a positive feedback on currently intensifying wildfires. These new long-term data improve our understanding of millennial-scale fire regime changes and their relationships to changes of vegetation in Central Yakutia, where the local population is already being confronted with intensifying wildfire seasons.

References

Glückler, R., Geng, R., Grimm, L., Baisheva, I., Herzschuh, U., Stoof-Leichsenring, K. R., Kruse, S., Andreev, A., Pestryakova, L., Dietze, E., 2022: Holocene wildfire and vegetation dynamics in Central Yakutia, Siberia, reconstructed from lake-sediment proxies. EGUsphere [preprint]. https://doi.org/10.5194/egusphere-2022-395

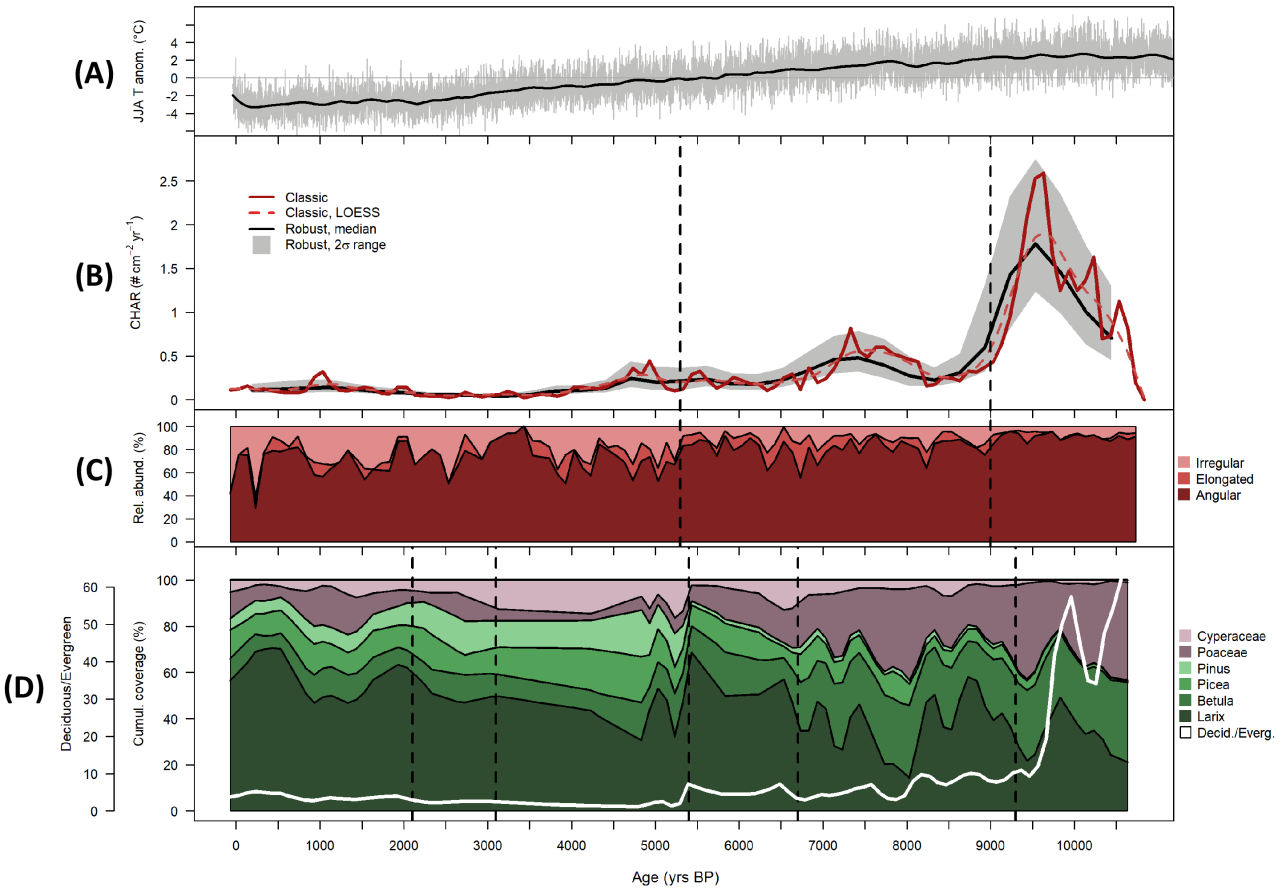

Fig. 1: *Synthesis of proxy data presented in Glückler et al. (2022[preprint]): (A) Modelled summer temperature, (B) Sedimentary charcoal, (C) Charcoal morphotypes, (D) Quantitative land cover reconstruction from sedimentary pollen.*

Session 2 – Abrupt Climate Change and Extreme Events

Dust provenance analyses show changes in air-masses circulation over the North African desert margin during the Holocene

Gravier, Blaise[1,2*]; Schmidt, Johannes[1]; Kertscher, Cathleen[1]; Schneider, Birgit[1]; Dietze, Elisabeth[4]; Benkaddour, Abdelfattah[5]; Mikdad, Abdeslam; Bolland, Alexander[1]; Fletcher, William[7]; Mischke, Steffen[8]; Galer, Stephen J.G. [2]; Haug, Gerald [2]; Zielhofer, Christoph [1] & Pichat, Sylvain [2,3]

[1] Institute of Geography, Leipzig University, Leipzig, Germany
[2] Climate Geochemistry, Max Planck Institute for Chemistry, Mainz, Germany
[3] Laboratoire de Géologie de Lyon (LGL-TPE), University of Lyon, Lyon, France
[4] Polar Terrestrial Environmental Systems, Alfred Wegener Institute for Polar and Marine Research, Research Unit Potsdam, Potsdam, Germany
[5] Department of Earth Sciences – Cadi Ayyad University, Marrakech, Morocco
[6] Institut National des Sciences de l’Archéologie et du Patrimoine, Rabat, Morocco
[7] Department of Geography, School of Environment, Education and Development, University of Manchester, Manchester, UK
[8] School of Engineering and Natural Sciences, University of Iceland, Reykjavík, Iceland
[*] Corresponding author: blaise.gravier@uni-leipzig.de

The North African desert margin is one of the areas most sensitive to ongoing climate change. Indeed, the area has recorded one of the largest temperature increases (> 2°C) between 1901 and 2012. In addition, models, coupled to historical data, forecast an increase in heat peaks and a reduction in rainfall leading to hyper aridity by 2100. Improving the scenarios of future climate evolution requires a state-of-the-art understanding of the response of natural systems to abrupt climate changes that occurred prior to the industrial era. In this regard, climate archives with high temporal resolution such as lake sediments are of prime importance for our understanding of the mechanisms that govern abrupt climate transitions in the climate system. Across the North African desert margin, variation in past hydro-climatic conditions is notably affected by changes in the air mass trajectories, whose temporal dynamics can be reconstructed using mineral aerosol (dust) provenance analysis. Indeed, the different sources of dust contributing to a given area are usually characterized by specific isotopic signatures in neodymium (Nd), strontium (Sr) and lead (Pb) notably depending on the age and conditions of geological formations.

In this study, we measured the Nd and Sr isotopic compositions in the “dust” fraction extracted from a sediment core of lake Sidi Ali, Middle Atlas, Morocco. There are coherent changes in the Sr and Nd isotopic compositions during the Holocene that we interpret as variations in the dust provenance. In particular, there is a pronounced decrease (increase) in the Nd (Sr) isotopic ratio around the 8.2 ka-climate anomaly likely reflecting a change in dust origin. Based on these preliminary results, Chad and/or Senegal could be the main contributors amongst the distal potential dust source areas while local contributions from Morocco could also occur. These results suggest that the sediment record from lake Sidi Ali is suitable for deciphering between major dust sources and for providing a high time-resolution in the air masses circulation changes along the North African desert margin during the Holocene. We will increase the temporal resolution of our current isotopic record with a focus on the Mid-Holocene Saharan aridification and measure the Pb isotopic compositions to complement the Nd and Sr isotopic records.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Neue Einblicke in die Stratigraphie der periglazialen Deckschichten basierend auf geochemischen und geophysikalischen Untersuchungen im südlichen Rheinischen Schiefergebirge bei Waldalgesheim (Rheinland-Pfalz, SW-Deutschland)

Grimm, Bastian E.W.W.[1*]; Grimm, Matthias C.[2] & Streb, Alexander R.[3]

[1] Johannes Gutenberg-Universität Mainz, Geographisches Institut, Mainz, Deutschland
[2] UDL Dr. Grimm, Mainz, Deutschland
[3] Mainz-Kostheim, Deutschland
[*] Kontakt: bgrimm@students.uni-mainz.de

Verschiedene Studien beschäftigten sich mit den periglazialen Deckschichten im Rheinischen Schiefergebirge. Die meisten Untersuchungen konzentrierten sich dabei auf die Lithostratigraphie, die Sedimentologie und die Pedologie oder auf Datierungsversuche (Semmel 1964, 1968; Zöller & Nehring 2002, Völkel et al. 2002). Bisher erfolgten aber keine detailierten geochemischen und geophysikalischen Untersuchungen an den periglazialen Deckschichten.

Im Rahmen dieser Arbeit wurden geochemische-mineralogische und geophysikalische Untersuchungen an den periglazialen Deckschichten bei Waldalgesheim (SE-Rheinisches Schiefergebirge) basierend auf der Röntgendiffraktometrie (XRD), der Röntgenfluoreszenzspektroskopie (XRF) und der volumetrischen magnetischen Suszeptibilität durchgeführt. Auf der Grundlage der sedimentologischen und geochemischen Daten kann zwischen vier Fazieseinheiten unterschieden werden: Oberlage („Deckschicht“) Hauptlage, Mittellage und Basislage.

Die Basislage enthält hauptsächlich aufgearbeitetes Material des liegenden Saprolits und detritische Tonminerale mit unverwittertem $2M_1$-Muskovit als Ausgangs- und 1Md-Illit als Endprodukt. Aufgrund von Überlegungen zur paläoklimatischen Entwicklung in Relation zur Lössbildung wird ihre Ablagerung während der Dansgaard-Oeschger Events DO 14 bis DO 12 angenommen (54.800 bis 47.000 a cal BP). Die Mittellage enthält Löss, in dem magnetisch und geochemisch auffällige Relikte der Eltville-Tephra (ca. 24.300 a cal BP) enthalten sind. An der Basis der darüber folgenden Hauptlage sind Reste der Laacher See-Tephra eingearbeitet (13.006 ± 9 a cal BP). Die Hauptlage wird deshalb in die Jüngere Dryas gestellt und zeigt im Topbereich eine leichte, vermutlich präboreale Vebraunung. Eine Oberlage im Sinne der Ad Hoc Arbeitsgruppe Boden (2005) ist nicht entwickelt, stattdessen konnte eine postglaziale Deckschicht nachgewiesen werden. Diese enthält aufgearbeitetes Material von hangaufwärts liegenden periglazialen Deckschichten, welches durch Rutschmasssen oder Solifluktion umgelagert wurde. Auf dieser postglazialen Deckschicht fand erneut eine Verbraunung statt, weshalb auch von einem präborealen Alter der Deckschicht ausgegangen werden kann. Diese Verbraunung dauerte wenigstens bis zum Misox-Kälteeinbruch im Atlantikum (= 8,2 ka-Event) an.

Literatur

Semmel, A., 1964. Junge Schuttdecken in hessischen Mittelgebirgen. Notizblatt des hessischen Landesamtes für Bodenforschung 92, 275-285.

Semmel, A., 1968. Studien über den Verlauf jungpleistozäner Formung in Hessen. Frankfurter Geographische Hefte 45, 1-133.

Völkel, J., Zepp, H., Kleber, A., 2002. Periglaziale Deckschichten in Mittelgebirgen – ein offenes Forschungsfeld. Berichte zur deutschen Landeskunde 76, 2/3, 101-114.

Zöller, L., Nehring, F., 2002. Solifluktions-, Löss- und Bodenbildungszyklen seit dem letzten Interglazial im Niederwesterwald. Berichte zur deutschen Landeskunde 76, 2/3, 115-130.

Session 5 – Earth Surface Processes and Environmental Change

Paleofire reconstructions from a thermokarst lake in Central Yakutia, Siberia

Grimm, Lennart[1,2*]; Glückler, Ramesh[1,3]; Herzschuh, Ulrike[1,3,4] & Dietze, Elisabeth[1,5,6]

[1] Polar Terrestrial Environmental Systems, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Potsdam, Germany
[2] Institute for Geosciences, University of Potsdam, Potsdam, Germany
[3] Institute for Environmental Science and Geography, University of Potsdam, Potsdam, Germany
[4] Institute of Biochemistry and Biology, University of Potsdam, Potsdam, Germany
[5] Organic Geochemistry, German Research Centre for Geoscience (GFZ), Potsdam, Germany
[6] now at: Institute of Geography, Landscape Geoscience, University of Göttingen, Göttingen, Germany
[*] Corresponding author: lennart.grimm@awi.de

Wildfires across the globe have received a considerable amount of public attention in recent years and although fire has been recognized as an important part of the global carbon cycle as well as a controlling element in the distribution of plants in the boreal forest, information about past fires in eastern Eurasia remains sparse when compared to other parts of the world. In the context of increasing burned area and carbon emissions from wildfires, as well as lengthening fire seasons in Siberia, the assessment of future ecosystem trajectories becomes increasingly important. Because instrumental records are short, the causal relationships of changing climate and changing fire regimes are not well established for large parts of the Siberian boreal forest and can only be inferred from paleoecological reconstructions.

The Siberian Arctic and subarctic is host to a great number of shallow thermokarst lakes (“alaas”-lakes), a majority of which were formed in the early Holocene (Katamura et al. 2004). Thus, on the one hand, these lakes represent a potential spatially comprehensive archive of Holocene fire regimes in Siberia that has remained largely unstudied. On the other hand, the nature of thermokarst processes active in and around these lakes potentially limits the reliability and informative value of sediment records from these lakes.

Here, we present an analysis of a charcoal record extracted from an Alaas lake spanning almost the entire Holocene. To quantitatively assess past changes in the amount of biomass burned, we counted macroscopic (> 150 µm) charcoal particles from a 120 cm long sediment core and calculated the charcoal accumulation rate (CHAR). Furthermore, the charcoal particles were assessed based on size and morphotype (Enache & Cumming 2007), allowing for the identification of changes in fuels and fire intensity. To relate changes in particle size and morphotype to changes in vegetation cover, a REVEALS-transformed pollen record was used (Glückler et al. 2022).

The established age model and stratigraphy suggest that thermokarst-related processes did not affect the paleoenvironmental record and that signals discussed here are clearly related to fire-vegetation interactions. We identify a peak in fire activity in the early Holocene, indicated by high CHAR values. An increased fraction of large charcoal particles in the early Holocene indicates that fires burned with higher intensity, thus generating larger, more angular particles and enabling longer-range transport of this charcoal type. This fire regime was associated with an open woodland ecosystem that likely supported more intense wildfires (discussed in detail in Glückler et al. 2022). A low-intensity fire regime developed in a closed larch forest in the middle Holocene, associated with low CHAR and an increase in the percentage of irregular smaller charcoal particles, suggesting that surface fires burning predominantly the litter layer dominated this ecosystem. Changes in morphotype composition are partially decoupled from changes in vegetation composition and CHAR, indicating that fire-vegetation relationships can only be understood in the context of other external factors such as changes in climate.

References

Dietze, E., Brykała, D., Schreuder, L.T., Jażdżewski, K., Blarquez, O., Brauer, A., Dietze, M., Obremska, M., Ott, F., Pieńczewska, A., Schouten, S., Hopmans, E.C., Słowiński, M., 2019. Human-induced fire regime shifts during 19th century industrialization: A robust fire regime reconstruction using northern Polish lake sediments. PLOS ONE 14, e0222011.

Enache, M. D., Cumming, B. F., 2007. Charcoal Morphotypes in Lake Sediments from British Columbia (Canada): An Assessment of Their Utility for the Reconstruction of Past Fire and Precipitation. Journal of Paleolimnology: 38/3, 347–363.

Glückler, R., Geng, R., Grimm, L., Baisheva, I., Herzschuh, U., Stoof-Leichsenring, K. R., Kruse, S., Andreev, A., Pestryakova, L., Dietze, E. 2022 (accepted). Holocene wildfire and vegetation dynamics in Central Yakutia, Siberia, reconstructed from lake-sediment proxies. In: Frontiers in Ecology and Evolution.

Katamura, F., Fukuda, M., Bosikov, N. P., Desyatkin, R. V., Nakamura, T., Moriizumi, J., 2006. Thermokarst Formation and Vegetation Dynamics Inferred from a Palynological Study in Central Yakutia, Eastern Siberia. Arctic, Antarctic and Alpine Research 38/4, 561–570.

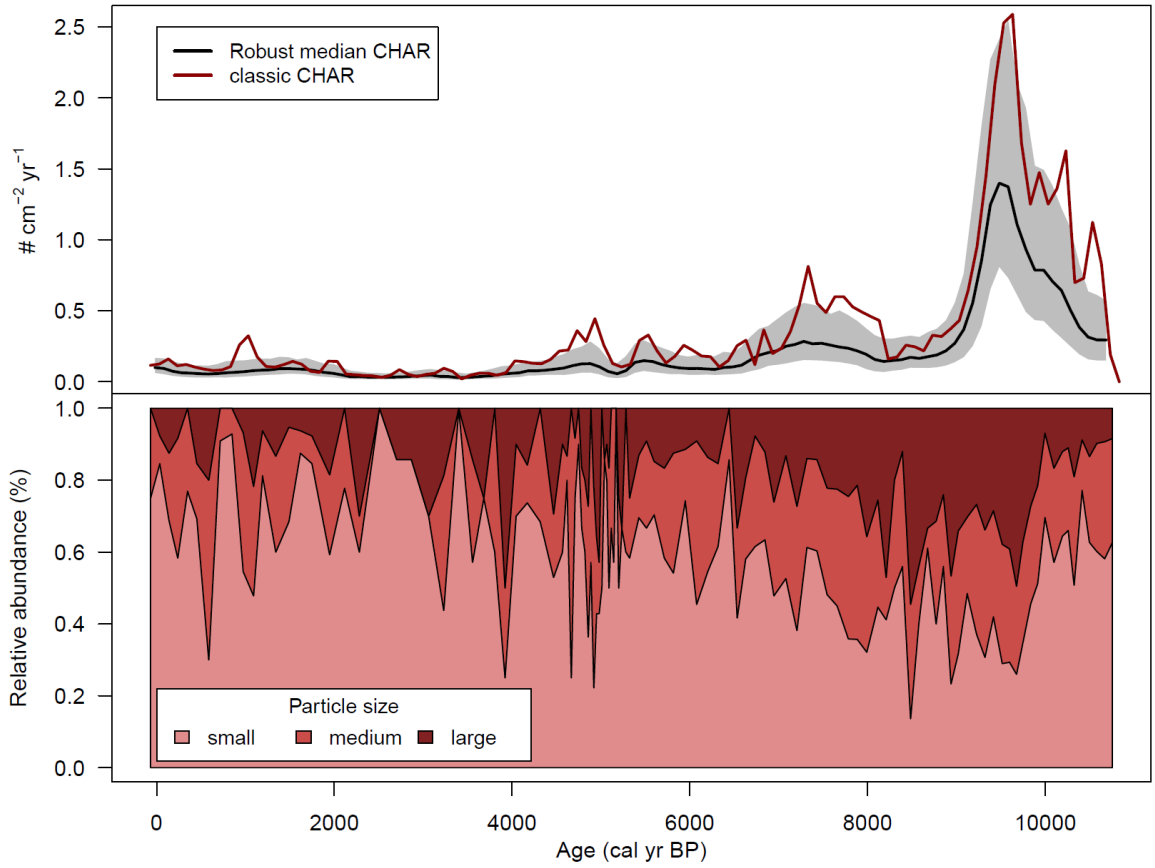

Fig. 1: *Top: Charcoal accumulation rate calculated in two different ways (robust CHAR and classic CHAR, see Dietze et al. 2019). Grey area indicates 50 percent interquantile range. Bottom: Percentages of different charcoal sizes throughout time. Small: 150 – 250 µm, Medium: 250 – 500 µm, Large: > 500 µm. Note that increased CHAR values shortly after 10 ka correspond to an increased fraction of large charcoal particles.*

Session 1 – Climate variability and warmer climates

Unlocking temperatures and lake levels archived in Holocene Dead Sea halite fluid inclusions

Guillerm, Emmanuel[1,2,*]; Lowenstein, Tim K.[2]; Gardien, Véronique[3]; Caupin, Frédéric[4] & Brauer, Achim[1]

[1] GFZ German Research Centre for Geosciences, Section Climate Dynamics and Landscape Evolution; Telegrafenberg, 14473 Potsdam, Germany
[2] Department of Geological Sciences and Environmental Studies, Binghamton University, Binghamton, New York 13902-6000, USA
[3] Univ Lyon, Université Claude Bernard Lyon 1, CNRS, Laboratoire de Géologie de Lyon Terre, Planètes et Environnement ; 2 rue Raphaël Dubois, Villeurbanne, France
[4] Univ Lyon, Université Claude Bernard Lyon 1, CNRS, Institut Lumière Matière; 10 rue Ada Byron, France
[*] Corresponding author. Email: emmanuel.guillerm@outlook.fr

In the early Holocene Jordan valley in the Levant, in a context of large global climatic and environmental reorganizations, groups of humans started to change their way of life and adopt many features of what we now call « civilization ». While the global frame of rising sea levels, temperatures and rainfall is established, the climatic and environmental conditions in the Levant during that time are still poorly constrained. Constraints on the annual and seasonal air temperatures are lacking. The amount of precipitation is unknown. The early Holocene lake level of the Dead Sea, the hypersaline lake in which the Jordan River flows, is a source of much debate, with proposed values ranging >100 meters. In this project, we will take advantage of the thick salt sequence that was deposited at the bottom of the Dead Sea throughout the Holocene and recovered by an ICDP drilling. The bottom-growth salt crystals contain myriads of fluid inclusions that are remnants of the lake water. We will use new methods, Brillouin spectroscopy and LA-ICP-MS on halite fluid inclusions, to reconstruct the lake salinity and composition, lake levels and temperature thoughout the Holocene. In particular, the numerous halite varves will allow for a seasonal resolution of temperature variability. We show results of this methodology applied on salt sequences of previous interglacial periods in the Dead Sea, and discuss preliminary results for the Holocene.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Subrecent Anthropogenic Impact on Sediments from Schweriner See

Haberzettl, Torsten[1*]; Adolph, Marie-Luise [1]; Troelstra, Veerle[1]; Dreßler, Mirko[1]; Wrozyna, Claudia[1] & Lorenz, Sebastian[1]

[1] University of Greifswald, Institute for Geography and Geology, Greifswald, Germany
[*] Corresponding author: torsten.haberzettl@uni-greifswald.de

As fourth largest lake in Germany and second largest lake in Mecklenburg-Vorpommern, Schweriner See is particularly well suited for paleoenvironmental reconstructions, since in such a system natural supraregional paleoenvironmental signals are not overridden by single events. However, due to its complex bathymetry the understanding of the spatial distribution of sediment components is limited. In this study we present sediment surface samples from 0.5 to 51.5 m water depth with a spatial resolution of 1.3 to 2 km, which reflect the current depositional conditions, as well as sediment short cores (max. 1 m length) representing the (sub-)recent past from Schweriner Außensee. Außensee is the northern basin of Schweriner See which is separated from the southern part called Innensee by a semi-artificial dam built until AD 1842.

Sediment surface samples from Schweriner Außensee indicate that as expected the distribution of most parameters is coupled to hydrodynamic processes. This, is, for example, reflected by a clear correlation of grain size or organic material with water depth. Carbonate deposition seems to be influenced by carbonate saturated groundwater input in the southern part of Außensee. This process has resulted in deposition of

abundant lake marl which was mined in former times. Distinct Fe, Zn and Pb concentrations at the eastern part of Außensee might be related to the railway line passing the lake in the east.

According to the $^{137}Cs/^{210}Pb$ and ^{14}C based chronology of one of our sediment cores our applied multi-proxy approach covers the time interval from AD 1345 $^{+55}/_{-45}$ until today with a much higher resolution in the upper and younger part of the record. We used sedimentary pigments derived from photospectrometer analysis, diatom abundances and CNS analyses to reconstruct eutrophication and also trace metals derived from XRF core scanning as contamination indicators. Both eutrophication and contamination tendencies are directly related to population dynamics of the city of Schwerin which is located on the south-eastern shore of Schweriner Innensee. A first slight increase in eutrophication can be observed in the 16th century. However, distinct increased eutrophication coupled with heavy metal contamination only started around AD 1900 when a sewage treatment plant was built which discharged sewage waters directly into Schweriner See. Maximum eutrophication was reached in the 1970s and an improvement in water quality only occurred after the German reunification when phosphor load was reduced by a) the introduction of phosphate-free washing detergents, b) a decrease in population and c) the launch of a new sewage treatment plant, which does not allow sewage waters to reach Schweriner See at all anymore.

Session 3 – Synchronisation and Dating of Proxy Records

First evidence for an LGM glaciation in the Central Mountain Range, Taiwan - dated with terrestrial cosmogenic nuclides

Hebenstreit, Robert[1*]; Hardt, Jacob[1] & Böse, Margot[1]

[1] Freie Universität Berlin, Institut für Geographische Wissenschaften, Berlin, Germany
[*] Corresponding author: robert.hebenstreit@fu-berlin.de

The Central Mountain Range of Taiwan is an isolated high-altitude area at the junction of the Eurasian continent and the western Pacific Ocean with elevations up to 3952 m. It represents therefore a unique location for paleoclimate research in monsoonal East Asia. The range is presently unglaciated, but various glacial landforms and sediments have been mapped and dated in several mountain massifs during the last two decades (Böse et al., 2014; Cui et al., 2002; Hebenstreit et al., 2011; Siame et al., 2007). They support the concept of repeated, multi-stage glaciations during the late Pleistocene and early Holocene. However, most evidences of glacial processes are restricted to the highest parts of the mountains (> 3000 m) so far, representing erosional landforms in the glacier accumulation area or deposits of younger glacier advances. Glacial deposits or landforms, which can be reliably attributed to the global Last Glacial Maximum (LGM), have up to now not been found in Taiwan.

For the first time we present evidence for a glaciation around the LGM. We mapped cirques in a relatively low altitude mountain section in the area south of the Nengao Shan massif in central Taiwan with floor elevations between 2700 to 2800 m above the sea level. Ten glacial boulders and rock surfaces of the cirques’ outlet were dated by means of paired (Be-10/ Al-26) in-situ produced cosmogenic nuclides (TCN, Gosse and Philips, 2001). The derived ages lie in the marine isotope stage 2 for boulders near or at the mountain crests above the cirques. Late-glacial to early Holocene ages were derived for the cirque outlets. From the data we reconstruct a plateau-like glaciation of this mountain section with the development of outlet valley glaciers during the LGM and a subsequent back-melting that resulted in cirque glaciers persisting in favorable downwind-positions until the early Holocene.

The derived last glacial equilibrium line altitude (ELA) was at 2800 m during the late glacial and early Holocene, but even lower during the LGM. This is the lowest ever reported ELA from the Taiwanese mountain range. With regards to the almost exclusively east facing cirque positions we discuss the influence of the East Asian monsoon system in relation to the westerly circulation at different altitudes and raise the question of

the source of solid precipitation in this subtropical high mountain range today and during the last glacial cycle.

References

Böse, M., Hebenstreit, R., Hardt, J., 2014. A deformation till at Hohuan Shan, Taiwan. Quaternary International 321, 55-58.

Cui, Z., Yang, C., Liu, G., Zhang, W., Wang, S., Sung, Q., 2002. The Quaternary glaciation of Shesan Mountain in Taiwan and glacial classification in monsoon areas. Quaternary International 97-98, 147-153.

Gosse, J.C., Phillips, F.M., 2001. Terrestrial in situ cosmogenic nuclides: theory and application. Quaternary Science Reviews 20, 1475-1560.

Hebenstreit, R., Ivy-Ochs, S., Kubik, P.W., Schlüchter, C., Böse, M., 2011. Lateglacial and early Holocene surface exposure ages of glacial boulders in the Taiwanese high mountain range. Quaternary Science Reviews 30, 298-311.

Siame, L., Chu, H.T., Carcaillet, J., Bourles, D., Braucher, R., Lu, W.C., Angelier, J., Dussouliez, P., 2007. Glacial retreat history of Nanhuta Shan (north-east Taiwan) from preserved glacial features: the cosmic ray exposure perspective. Quaternary Science Reviews 26, 2185-2200.

Fig. 1: *Example of a cirque with an over-deepened floor and a polished threshold at ca. 2700 m asl. TCN samples were taken near the outflow in the picture center (N 23.923556, E 121.281472) and on the crest near the photo shooting location. View to the east.*

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Palynologische Untersuchungen zu Biostratigraphie und Paläoumwelt des Mittelpleistozäns in Thüringen

Höfer, Dana[1*]; Stebich, Martina[1]; Lauer, Tobias[2] & Katzschmann, Lutz[3]

[1] Senckenberg Forschungsstation für Quartärpaläontologie, Weimar, Germany
[2] Eberhard-Karls-Universität, Angewandte Geowissenschaften, Terrestrische Sedimentologie, Tübingen, Germany
[3] Thüringer Landesamt für Umwelt, Bergbau und Naturschutz, Weimar
[*] Corresponding author: dana.hoefer@senckenberg.de

Im Rahmen eines gemeinsamen Forschungsprojekts des Thüringer Landesamtes für Umwelt, Bergbau und Naturschutz und Senckenberg werden detaillierte palynologische Untersuchungen an Thüringer Sedimenten gefördert, die neue Erkenntnisse zur biostratigraphischen Klassifikation unter- bis mittelpleistozäner Vegetationsabfolgen liefern sollen. Ein weiteres Ziel dieser Arbeiten ist ein besseres Verständnis der quartären Vegetationsdynamik und Klimavariabilität und des damit zusammenhängenden räumlichen und zeitlichen Subrosionsgeschehens innerhalb der biogeographisch-klimatischen Brückenregion Thüringen.

Die Mehrzahl des untersuchten Sedimentmaterials stammt aus Bohrungen und Aufschlüssen aus der durch Subrosion beeinflussten Kyffhäuserregion und dem Werratalgebiet in Südthüringen (Abb. 1). Im Jahre 2020 wurde außerdem eine weitere vom Land Thüringen geförderte 92m tiefe Forschungsbohrung im Unstrutried (FB Art 1/2020) abgeteuft. Diese bildet eine wichtige Grundlage für die Erweiterung der biostratigraphischen Information durch die Ausdehnung der Bohrtiefe sowie zusätzlicher Datierungen.

Im gesamten Projektzeitraum wurden über 20 teilweise fragmentarisch überlieferte Interglazialsequenzen nachgewiesen. Davon sind einige typische Pollenspektren untereinander gut parallelisierbar und bilden zeitgleiche Sedimentationszeiträume ab. Die biostratigraphische Einstufung der gewonnenen Pollendaten erfolgte über den Vergleich mit regionalen und überregionalen Pollendiagrammen sowie auf Basis von Sedimentstratigraphie, Fossilien, Makroresten und Lumineszenz-Datierungen. Zu den bedeutendsten Ergebnissen dieser Untersuchungen zählen die gewonnenen Daten aus der Neubearbeitung des Muscheltons (Artern-Interglazial) und der Lehmzone (Cromer-Komplex) bei Voigtstedt, ein weiteres, maximal frühcromerzeitliches Interglazial bei Möhra, ein Holstein-typisches Interglazial bei Esperstedt, sowie eine Warmzeiten-Abfolge im Unstrutried und in der Helme-Aue, die überwiegend dem Saalekomplex zugeordnet werden. Diese Sequenz ist am besten in der Forschungsbohrung FB Art 1/2020 überliefert und bildet den Schwerpunkt der vorgestellten Ergebnisse. Hier zeigen sich deutliche Parallelen zum Pollendiagramm aus dem Neualbenreuth Maar, dessen Sedimente eine komplette Abfolge von MIS 8 bis MIS 5 in Superposition umfassen (Abb. 2, Stebich et al. 2020). Im Liegenden der warmzeitlichen schluffig-sandigen Sedimente der Forschungsbohrung FB Art 1/2020 sind flintführender Till sowie Bänderschluff und darunterfolgend flintfreie kaltzeitliche Ober- bzw. Hochterrassensedimente abgelagert. Durchgeführte Infrarot-Radiofluoreszenz-Datierungen unterstützen die Alterseinstufung zweier Interglazialabschnitte in das MIS 7 und legen eine Einstufung der ältesten im Kern überlieferten Warmphase in das MIS 9 nahe. Die Datierung an den kaltzeitlichen flintführenden Sedimenten im Liegenden belegt die Einstufung in das MIS 12. Somit ist im Profil der Forschungsbohrung erstmals ein Nachweis der Interglaziale von MIS 9 und MIS 7 in Superposition in Thüringen belegt.

Des Weiteren können mit Hilfe der vorliegenden Pollendaten aus dem Unstrutried, der Helme-Aue und des Werratals sowie der daraus resultierenden Teufen-Parallelität zur Zeit der Ablagerung neue Modellansätze zu den Subrosionsprozessen erarbeitet werden.

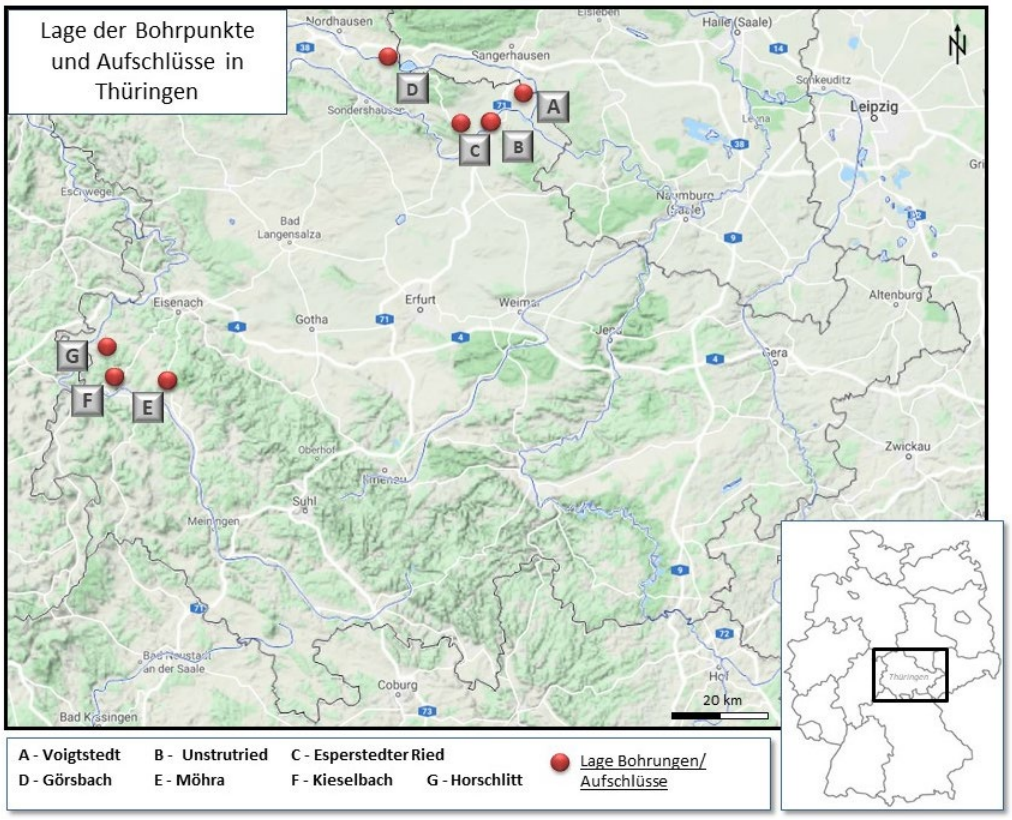

Abb. 1: *Lage der untersuchten Bohrpunkte und Aufschlüsse in Thüringen*

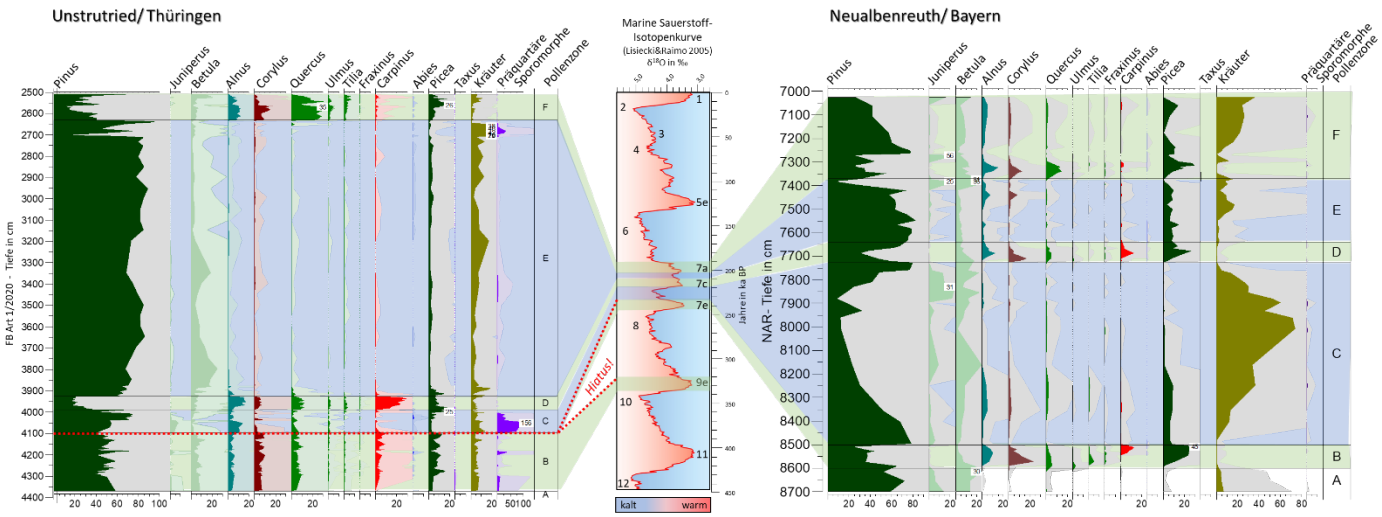

Abb. 2: *Gegenüberstellung der Diagramme der Forschungsbohrung FB Art 1/2020 aus dem Unstrutried und Neualbenreuth (verändert nach Stebich et al. 2020)*

Literatur

Stebich, M., Höfer, D., Mingram, J., Nowaczyk, N., Rohrmüller, J., Mrlina, J., Kämpf, H., 2020. A contribution towards the palynostratigraphical classification of the Middle Pleistocene in Central Europe: The pollen record of the Neualbenreuth Maar, northeastern Bavaria (Germany). Quaternary Science Reviews 250.

Session 1 – Climate variability and warmer climates

Spatio-temporal distribution of ostracod species in saline inland lakes (Mansfeld lake area; Central Germany)

Höhle, Marlene[1*], Wrozyna, Claudia[2*]

[1]Institute for Geophysics and Geology, University of Leipzig, Leipzig, Germany.
[2]Institute for Geography and Geology, University of Greifswald, Greifswald, Germany.
Corresponding authors: marlene.hoehle@uni-leipzig.de, claudia.wrozyna@uni-greifswald.de

Ostracods are a diverse group of microcrustaceans with a ubiquitous distribution in a wide array of aquatic habitats and are common constituents of lake sediments. Inferences on temporal-spatial distribution of ostracod species is the prerequisite for reconstructions of palaeoenvironmental conditions. This requires a precise knowledge not only about ecological preferences and specific life histories, but also the understanding how (local) ecological parameters affect ostracod species assemblages (abundance and composition). Generally, these studies are rare and often characterized by an insufficient differentiation of living specimens from the total amount of valves of the modern population leading to uncertainties in species occurrences and diversity data.

Modern ostracod populations were sampled from 12 water bodies within a relatively small study area (Mansfeld lake area, Central Germany). Physico-chemical parameters (temperature, oxygen content, conductivity, pH) were measured *in situ* and the uppermost 2 cm of sediment were collected in different seasons (April, June, September). Relative abundances of ostracods (living and dead), differentiated for adults and juveniles, were used for statistical analyses (Spearman`s rank correlation, Canonical correspondence analysis, Cluster analyses, Fisher´s α), to investigate relationships between species distribution and environmental factors as well as to identify habitat similarities and ostracod species assemblages.

In total, 27 ostracod species (20 living species) were identified. Majority of them are considered as very common (cosmopolitan) freshwater species. Only two species are usually known from brackish water (*Cytheromorpha fuscata* and *Cyprideis torosa*). This is the first confirmation of living *C. torosa* in German inland waters. The relative abundances of ostracods show strong fluctuations during the study period and differences in composition of the ostracod species assemblages between and within the water bodies. There are also strong differences between bio- and taphocoenoses.

The measured physico-chemical parameters which are usually considered as most important drivers on ostracod species distribution do not contribute to explain the observed temporal-spatial distribution of the ostracod species. Differences in taphocoenoses show, that taphonomic processes can be very local and the sampling site, as well as the sampling time, is crucial. This must be taken into account when fossil material is interpreted in terms of biodiversity, (palaeo-) limnological and (palaeo-) ecological conditions.

Also biodiversity of ostracods is biased by sampling time, the variability of the ostracod assemblages between sampling month and the relationship between abundance of valves and living ostracods is not straightforward. Therefore, without precise knowledge of the ecological requirements of a species at a local scale, uncertainties may exist for the palaeoecological indication of a species.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Zeitpunkt des spätpleistozänen Vergletscherungsmaximums und Chronologie der Gletscherveränderungen am Ende der letzten Deglaziation des Südschwarzwaldes, Deutschland: vorläufige Ergebnisse

Hofmann, Felix Martin[1*]; Schimmelpfennig, Irene[2]; ASTER Team[2**] & Preusser, Frank[1]

[1] Universität Freiburg, Institut für Geo- und Umweltnaturwissenschaften, Freiburg im Breisgau, Deutschland
[2] Universität Aix-Marseille, CNRS, IRD, INRAE, Aix-en-Provence, Frankreich
** Aumaître, Georges; Keddadouche, Karim & Zaidi, Fawzi
* Kontakt: felix.martin.hofmann@geologie.uni-freiburg.de

Während des Spätpleistozäns waren die höchste Erhebung des Schwarzwaldes, der Feldberg (1493 m ü. NHN) und die umliegende Region zeitweise von einer Eiskappe und ihren Auslassgletschern bedeckt. Während der darauffolgenden Deglaziation zerfiel die Eiskappe zunächst in Talgletscher und dann in einzelne Kargletscher. Über den zeitlichen Ablauf der letzten Vergletscherung des Südschwarzwaldes ist noch wenig bekannt. Dies gilt insbesondere für den spätpleistozänen Maximalstand und für Gletscherveränderungen am Ende der letzten Deglaziation (Hofmann et al., 2020).

^{10}Be Oberflächenexpositionsdatierungen wurden für die Altersbestimmung von großen und geomorphologisch stabilen Blöcken auf Moränen eingesetzt, die mit dem spätpleistozänen Vergletscherungsmaximum korreliert wurden. Der spätpleistozäne Maximalstand fand vor mindestens 21 ka (Kilojahre vor 2010 nach unserer Zeitrechnung) statt. Die Oberflächenexpositionsalter sind etwa 2 bis 3 ka jünger als Lumineszenzalter und Oberflächenexpositionsalter aus dem nördlichen Alpenvorland. Diese Diskrepanz wirft die Frage auf, ob die Vergletscherungsmaxima in diesen Regionen zu unterschiedlichen Zeitpunkten stattfanden. Interessanterweise stimmen die Altersdaten aus dem Südschwarzwald gut mit jenen aus dem Bayerischen Wald überein. Um diese Arbeitshypothesen zu testen, werden jedoch weitere Oberflächenexpositionsalter aus dem Südschwarzwald benötigt.

Zusätzlich wurden Oberflächenexpositionsdatierungen an Moränen durchgeführt, die mit der letzten Deglaziation korreliert werden. Das Rückschmelzen des Eises von der tiefstgelegenen beprobten Moräne setzte vor mindestens 16 ka ein. Moränen ähnlichen Alters sind bereits im Südschwarzwald identifiziert worden (Hofmann et al., 2022). Die Datierung einer Moräne in einer morphostratigraphisch jüngeren Position ergab ein Alter von ungefähr 13 ka. Es kann nicht ausgeschlossen werden, dass die Beprobungsflächen deutlich nach dem Rückschmelzen des Eises freigelegt wurden, da die beprobten Oberflächen nicht weit über der Geländeoberfläche lagen. Drei kohärente Alter von Moränen einer Eisrandlage im höchstgelegenen Kar des Südschwarzwaldes führen zum Schluss, dass sich die Moränen vor mindestens 12.500 Jahren bildeten. Nach der Auffassung der Autoren führte der rasche Rückgang der Sommertemperaturen in Zentraleuropa vor etwa 12.700 Jahren (Heiri et al., 2014 und Literaturstellen darin) zu einer erneuten Vergletscherung des Kars oder zu einem Wiedervorstoß eines bestehenden Gletschers. Das Oberflächenexpositionsalter der Moräne kann als weiterer Hinweis darauf gewertet werden, dass in den Mittelgebirgen Zentraleuropas eine Phase des Gletscherwachstums als Reaktion auf den Rückgang der Sommertemperaturen einsetzte (vgl. Engel et al., 2014 und Literaturstellen darin).

Literatur

Engel et al., 2014. ^{10}Be exposure age chronology of the last glaciation in the Krkonoše Mountains, Central Europe. Geomorphology 206, 107–121.

Heiri et al., 2014. Palaeoclimate records 60-8 ka in the Austrian and Swiss Alps and their forelands. Quaternary Science Reviews 106, 186–205.

Hofmann et al., 2022. Late Pleistocene glaciation history of the southern Black Forest, Germany: ^{10}Be cosmic-ray exposure dating and equilibrium line altitude reconstructions in Sankt Wilhelmer Tal. Journal of Quaternary Science 37, 688–706.

Hofmann et al., 2020. Revisiting Late Pleistocene glacier dynamics north-west of the Feldberg, southern Black Forest, Germany. E&G Quaternary Science Journal 69, 61–87.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Die Forschungsbohrung Riedstadt-Erfelden und neue Ergebnisse zur Geologie des nördlichen Oberrheingrabens

Hoselmann, Christian[1*]; Mair, Johannes[2] & Wedel, Joachim[1]

[1] Hessisches Landesamt für Naturschutz, Umwelt und Geologie, Wiesbaden, Germany
[2] Technische Universität Darmstadt, Institut für Angewandte Geowissenschaften (Fachgebiet Ingenieurgeologie), Darmstadt, Germany
* Kontakt: christian.hoselmann@hlnug.hessen.de

Basierend auf den Forschungsbohrungen in Viernheim, Heidelberg und Ludwigshafen wurde von den Staatlichen Geologischen Diensten in Hessen, Baden-Württembergund Rheinland-Pfalz sowie dem Leibniz-Institut für Angewandte Geophysik (LIAG) ein lithostratigraphisches Konzept für die quartäre und pliozäne Sedimentfüllung des nördlichen Oberrheingrabens (nORG) erarbeitet (GABRIEL et al. 2013). Am Kernmaterial wurden in den letzten Jahren verschiedene Untersuchungen u. a. zur Sedimentpetrographie, Gesteinsmagnetik, Paläobotanik, Lumineszenzdatierung und Sedimentologie durchgeführt, die das Bild der geologischen Entwicklung des nORG der letzten gut fünf Millionen Jahre erheblich erweitert haben. Ein weiterer Aspekt war die geologische Modellierung der obersten 150 m des hessischen Anteils des nORG mit der Erstellung eines 3D-Modells sowie eines Wahrscheinlichkeitenmodells zur Verbreitung von bindigen und nicht bindigen Horizonten (HOSELMANN & LEHNÉ 2014). Damit können insbesondere auch angewandte Fragestellungen der Hydro- und Rohstoffgeologie besser bedient werden. Um Erkenntnislücken im nördlichen Gebiet des nORG zu schließen und einen vollständigen Kern der pliozänen Iffezheim-Formation zu erhalten, wurde daher bei Riedstadt-Erfelden rund 10 km westlich von Darmstadt eine Forschungsbohrung mit einer Endteufe von 500 m geplant.

Die Forschungsbohrung wurde 2020/21 ausgeführt, hat aber aufgrund technischer Schwierigkeiten nur eine Endteufe von 323 m erreicht. Die wissenschaftliche Bearbeitung des sehr guten Kernmaterials hat begonnen und Ergebnisse zur Bohrlochgeophysik, geologischen Bearbeitung, Schwermineralanalyse, Korngrößenanalyse sowie Untersuchungen an Mollusken liegen vor und zeigen ein differenziertes Bild der pliozänen und pleistozänen Landschaftsentwicklung im nORG (Abb. 1). Weiterführende Untersuchungen zur Altersbestimmung mit Lumineszenzdatierungen, ^{14}C-Datierungen, Palynologie, Tonmineralanalyse etc. werden folgen.

Eingebunden ist die Forschungsbohrung in ein Projekt zur Neotektonik im nORG. Mit Hilfe verschiedener geophysikalischer Messmethoden (P-Wellen-Seismik, S-Wellen-Seismik, Geoelektrik, Georadar) wird das Gebiet engmaschig untersucht und erste Ergebnisse zur quartären Tektonik und zur Tiefenlage der Störungen können bereits präsentiert werden. Ziel ist es auch Migrationspfade von Radon im Bereich von Störungen besser zu verstehen.

Literatur

GABRIEL, G., Ellwanger, D., Hoselmann, C., Weidenfeller, M., Wielandt-Schuster, U., 2013. The Heidelberg Basin, Upper Rhine Graben (Germany): a unique archive of Quaternary sediments in Central Europe. Quaternary International 292: 43–58; DOI: 10.1016/j.quaint.2012.10.044.

HOSELMANN, C., LEHNÉ, R., 2014. Die quartärgeologische Entwicklung und ein geologisches 3D-Modell des nördlichen Oberrheingrabens. Geologisches Jahrbuch Hessen 138: 57-73.

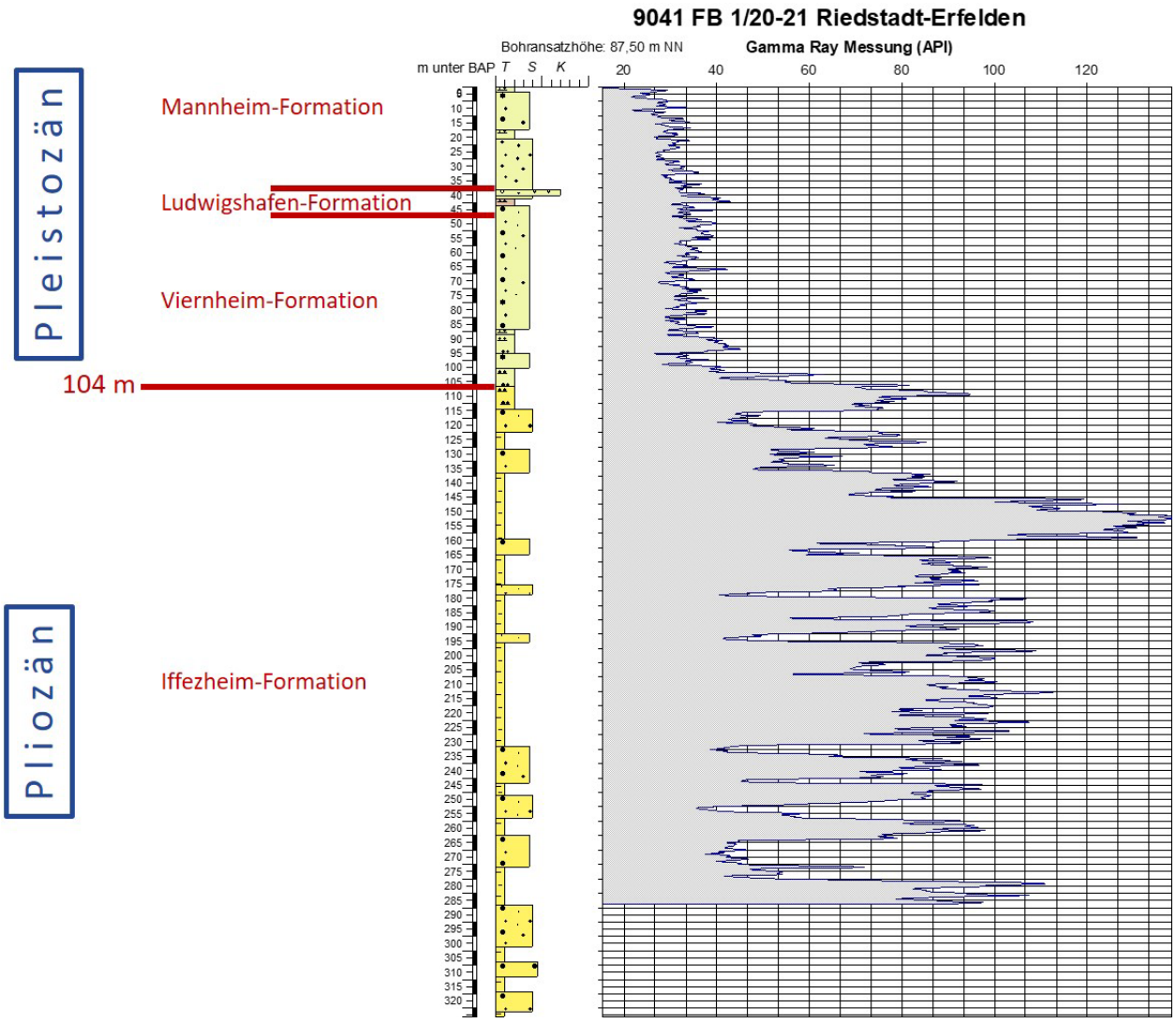

Abb. 1: *Stark generalisiertes Korngrößenprofil der Forschungsbohrung bei Riedstadt-Erfelden mit lithostratigraphischer Einstufung und Gammalog (Messung durch LIAG).*

Session 2 – Abrupt Climate Change and Extreme Events

Response of the European hydroclimate to a slowdown of the Atlantic Meridional Overturning Circulation

Monica Ionita-Scholz

Alfred-Wegener-Institut für Polar- und Meeresforschung, Am Handelshafen 12, 27570 Bremerhaven, Germany
Corresponding author: Monica.Ionita@awi.de

The Atlantic Meridional Overturning Circulation (AMOC) is a key component of the Earth climate, which can significantly imprint the vertical structure of global ocean heat uptake and drives a large part of the deep-ocean oxygenation and deep storage of anthropogenic carbon. The AMOC is expected to slow down with climate change with strong impact on the North Atlantic realm climate. In this respect, one of the key questions is how the frequency and magnitude of extreme hydroclimatic events (e.g., droughts, floods, heatwaves) will behave in response to a potential slowdown or shutdown of AMOC (i.e., a tipping point). Building upon the potential relationship between drought variability and large-scale oceanic and atmospheric circulation, we show that the observed drying trend in the central and southern parts of Europe has been driven by a long-term slowdown of the Atlantic Meridional Overturning Circulation (AMOC), via changes in the large-scale atmospheric circulation. A weakening of AMOC leads to an increase in the frequency of atmospheric-blocking like circulation over the central part of Europe, which in turn inhibits precipitation and favors long-term drying. Since climate projections indicate a slowdown of the AMOC in the future, we suggest that this will potentially lead to an increase in the frequency of dry years, especially over the central and southern parts of Europe (e.g., the eastern part of Germany, the Czech Republic, Poland, Spain and Portugal).

Session 5 – Earth Surface Processes and Environmental Change

From meandering riverbeds to an artificial channel – Late Pleistocene and Holocene development of River Welse (NE Brandenburg)

Juschus, Olaf[1*]; Probst, Robert[1]; Frömberg, Pia[1] & Strahl, Jaqueline[2]

[1] HNE Eberswalde, Faculty of Landscape Management and Nature Conservation, Eberswalde, Germany
[2] LBGR Brandenburg, Geological Survey, Cottbus, Germany
* Corresponding author: olaf.juschus@hnee.de

As a small river in north-eastern Brandenburg, the river Welse drains the backland of the Pomeranian terminal moraines towards river Oder. The so-called Welse-Valley, as a prominent basin zone, is a large subglacial meltwater channel. The channel infill consists of lower meltwater sands and upper periglacial-limnic fine sands and silts. Late glacial and Holocene telmatic deposits are found at the surface. The fluvial activity of the river has only slightly modified the geological conditions. All in all five river-bed generations of river Welse were identified:

1. In the northern part of the Valley, palaeo-meanders are found as large meanders (radius 50-60 m). They flowed into a palaeolake; the sediments of which were crossed by the pipeline-trench. Peat and silt with intercalated sand layers were found. The sands are interpreted as fluvial input. While the exact age of the palaeo-meanders has not been clarified; the lake infill is of Lateglacial age.
2. Deposits of the second fluvial generation were detected directly in the pipeline trench. They consist of fluvial fine sands intercalating with peat. It is interpreted as a boggy river bank. The sediments are cryoturbated. Radiocarbon dating of pine-cones, found close to the base of the peat, revealed an Boelling-Age. The associated palaeo-meanders have meander radiuses of around 30 m.

3. The following river-bed generation can be traced in the DEM as meandering palaeochannels with a radius of about 20 m. Humic fine sands intercalating with peat were found in the pipeline trench. The Radiocarbon ages of the peats revealed a Subatlantic formation of the meanders.
4. and 5. The most recent river-bed generations of the river are a result of the strong human impact. Around 1800, the meandering course of the Welse was straightened. River sediments deposited during this period are significantly coarser and largely peat-free. They give evidence of the decoupling of the river from its surroundings. The current riverbed was built between 1969 and 1979 as an artificial channel. It is deepened into the surrounding landscape by approx. 1.5 m.

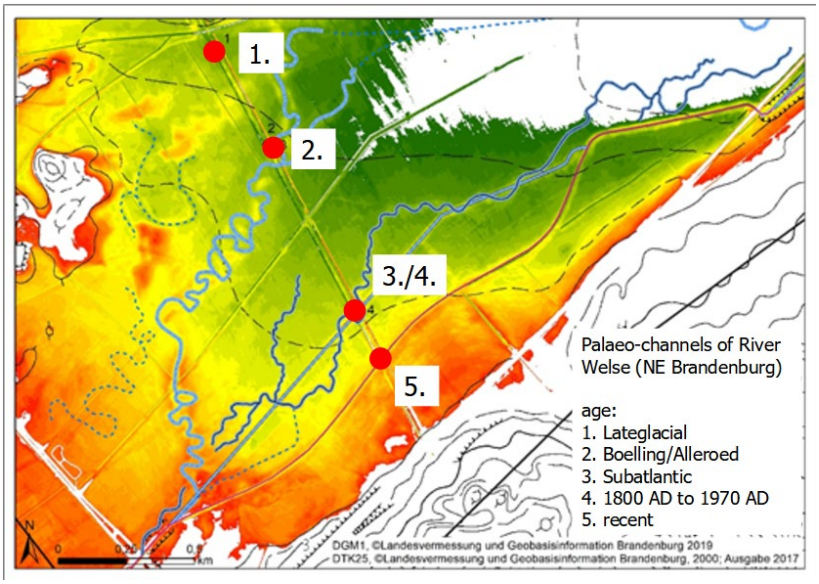

Fig. 1: *Palaeochannels of river Welse on the DEM of the area (heights between 9 and 11 m a.s.l.).*

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Tracing the impact of settlements on landscape transformations during the last 1200 years of Greater Poland recorded in the Lednica Lake sediments – based on the multiproxy approach

Juśkiewicz, Włodzimierz[1*] & Pydyn, Andrzej[2]

[1] Polish Academy of Sciences, Institute of Geography and Spatial Organization, Department of Environmental Resources and Geohazards, Toruń, Poland
[2] Nicolaus Copernicus University, Faculty of History, Institute of Archeology, Department of Prehistory, Toruń, Poland
* Corresponding author: w.juskiewicz@geopan.torun.pl

The Slavic expansion to Central and Eastern Europe in the Late Iron Age and the Middle Ages (5th – 15th centuries) is well documented archaeologically and historically. This process of colonization was fundamental to the expansion of European, later Christian societies, and had a great influence on the physical and cultural landscapes of Central and Eastern Europe. The impact of these processes on landscape and land use has traditionally been studied through archaeological and historical sources, and rarely through integration with multi-directional palaeoenvironmental research. In today's Poland, most of the palynological research focused on the reconstruction of patterns of changes in vegetation and human activity over several millennia. Less research is focused specifically on the Middle Ages, where the most intensive landscape colonization took place (Buko, 2008; Pluskowski, 2012).

The formation of the Polish State (Piast dynasty) by the middle of the 10th century is characterized by an increase in conquests and colonization, and after their conversion to Catholicism in 966 AD, by increasing

missionary activity for conversion. A very important role in this process was played by the residential and religious centre located on the islands of Lake Lednica. The settlement located here was one of the focal points of the state of the first Piasts. Conquest, colonization, and religious conversion went hand in hand with agricultural intensification, economic expansion and the development of pan-European trade networks.

The research is to analyse the ecological signals of colonization and economic and agricultural intensification in the Middle Ages by comparing the results of pollen composition, geochemical analyses from Lake Lednica (palynological, micro and macro charcoal analysis, geochemical analysis (μ-XRF core scanner)) - (Fig. 1). The comparison will concern the core from the excavation in the area of the bridge and the core, which will be collected in the area beyond the impact range of the bridge in the deepest part of the lake (13 m).

The first results of the research suggest that there may have been two crossings to the island of Ledniczka. The first one was built in the 10th century, then most likely there was a break in its use (Pydyn, 2018). At the turn of the thirteenth and fourteenth centuries, another bridge was built. The distinction between the construction and operation phases of the crossings is visible in the cultural layers that are cut off from each other and thanks to the dendrochronological dates only for the wooden structures of the bridge. However, confirmation of this thesis and the reconstruction of the influence of settlement requires more extensive research. The final result of the research will be a deep understanding of the relationship between the beginnings of the Piast dynasty and the transformation of the natural landscape into a cultural landscape.

References

Buko, A., 2008. The archaeology of early medieval Poland: Discoveries—hypotheses—interpretations. Leiden: Brill.

Pluskowski, A.G., 2012. The archaeology of the Prussian crusade: Holy war and colonisation. London: Routledge.

Pydyn, A., 2018. Sprawozdanie z archeologicznych badań podwodnych przeprowadzonych na reliktach mostu na Ledniczkę (Rybitwy, stan. 28) oraz prospekcji podwodnych zrealizowanych w sąsiedztwie tej wyspy w dniach 04. 07 – 30. 07. 2018 roku. Ms. dep. in the archive of the Uniwersytet Mikołaja Kopernika w Toruniu.

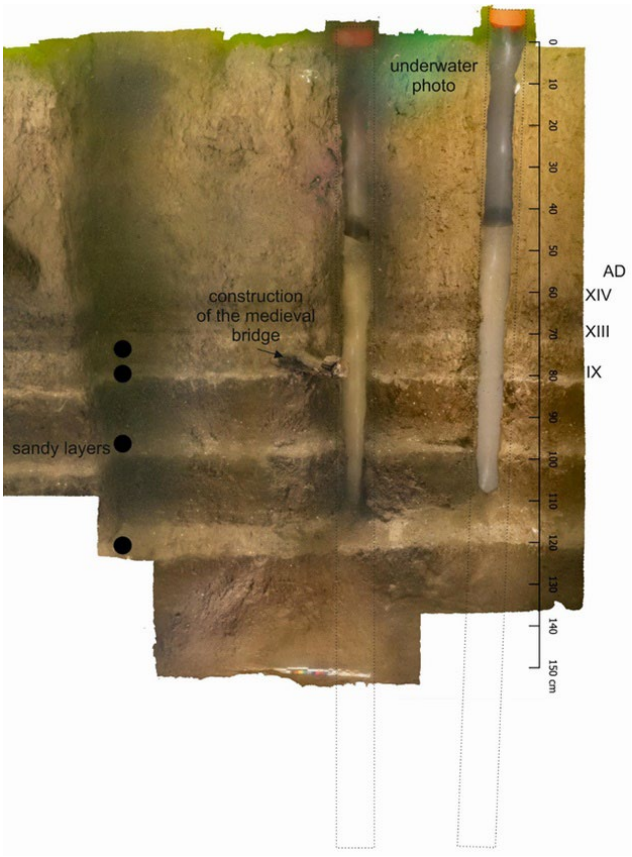

Fig. 1: *Underwater photography of the sediment collection site (age determined on the basis of radiocarbon and dendrochronological dates of wooden elements of the medieval bridge structure; sandy layers connected with the bridge and older, unidentified layers).*

Session 5 – Earth Surface Processes and Environmental Change

Ice flow pattern of the late LGM Rhine glacier, northern Alpine foreland, reconstructed from a new inventory of streamlined subglacial bedforms

Kamleitner, Sarah[1*]; Ivy-Ochs, Susan[1]; Salcher, Bernhard[2] & Reitner, Jürgen M.[3]

[1] ETH Zurich, Laboratory of Ion Beam Physics, Zurich, Switzerland
[2] University of Salzburg, Department of Geography and Geology, Salzburg, Austria
[3] Geological Survey of Austria, Vienna, Austria
* Corresponding author: kamsarah@phys.ethz.ch

We present a first inventory of subglacial landforms of the LGM Rhine piedmont glacier, one of the largest glacier systems of the Alpine LGM ice cap. In analogy to work from the Northern Hemispheric ice sheets, we in a second step use orientation and morphometry of streamlined bedforms to deduce paleo ice flow patterns thereby providing new insights to the existing paleoglaciological reconstructions of the LGM Rhine glacier.

On the basis of high-resolution elevation data, more than 2500 streamlined bedforms, mainly drumlins, where mapped within the area of the former LGM Rhine glacier. The majority of subglacial landforms is organized in fields internal to the frontal moraines of the Stein am Rhein stadial that are associated with a late LGM readvance. Typically occurring isolated and scattered, only a fraction of mapped drumlins is located between the Stein am Rhein ice margin and the moraines of the LGM maximum position (Schaffhausen stadial). Mapped drumlins exhibit length and width ranges of ~70–2450 m and ~40–500 m, respectively. Drumlin relief reaches from few metres up to more than 60 m. Mapped bedform orientations of the Stein am Rhein flow set build the basis for reconstructing basal ice flow directions during the glacier advance to and stabilization at the Stein am Rhein stadial. A continuous paleo flow field of the late LGM Rhine glacier is inferred by implementing a new kriging approach following Ng and Hughes (2019). Resulting flow fields highlight the spreading nature of the late LGM Rhine glacier emanating from a single valley outlet and fanning out towards the margins. Paleo flow directions correspond well with this expansion and are oriented perpendicular to the former glacier front as reconstructed from frontal moraine ridges of the Stein am Rhein stadial. Gained flow trajectories distinctly deflect around topographic bumps at different scales and converge in narrow valley sections. These results suggest that during the late phase of the LGM, basal flow was strongly controlled by topography. Furthermore, variations in length-to-width ratios of streamlined bedforms highlight relative differences in basal flow velocities across the late LGM piedmont glacier lobe. Elongated subglacial features group along major troughs and point to zones of fast-flowing ice, which is in accordance with results from numerical simulations.

References

Ng, F. S. L., Hughes, A. L. C., 2019. Reconstructing ice-flow fields from streamlined subglacial bedforms: A kriging approach. Earth Surface Processes and Landforms 44, 861–876.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Ein Fenster in den Sumpfzypressenwald von Rastatt

Kaufmann, Uwe[1]; **Wielandt-Schuster, Ulrike[2*]** & Hahne, Jürgen[3]

[1] Ingenieurgemeinschaft Bauüberwachung Tunnel Rastatt, Ötigheim, Germany
[2]Regierungspräsidium Freiburg Abt. 9 - Landesamt für Geologie, Rohstoffe und Bergbau, Freiburg, Germany
[3]Dassel, Germany
* Kontakt: ulrike.wielandt-schuster@rpf.bwl.de

Seit den 1980er Jahren wird an der Schnellfahrstrecke der Deutschen Bahn durch den Oberrheingraben gearbeitet. Der Abschnitt zwischen Rastatt Süd und Offenburg ist bereits fertiggestellt, am Teilprojekt Tunnel Rastatt wird noch gebaut. Im Zuge der Realisierung des Tunnel-Querschlags QS5 wurde untertägig in 24-25m die Schichtgrenze Iffezheim zur überlagernden Ortenau-Formation aufgeschlossen und photogrammetrisch dokumentiert.

Unterhalb der Schichtgrenze sind die hell gefärbten schluffig tonigen Feinsedimentabfolgen der Iffezheim-Formation aufgeschlossen. Sie sind durchgehend kalkfrei und werden aus lokalen Liefergebieten hergeleitet. Am Top ist ein dunkler Paläoboden mit Holzresten entwickelt. Dieser wird mit erosivem Kontakt von alpinen Kiesschüttungen abgelöst, wobei es zur Aufarbeitung und Resedimentation des Unterlagers kam. Holzstücke wurden umgelagert, ein großer Wurzelstrunk konnte geborgen werden.

Palynologisch konnte aus diesem Horizont eine pliozäne Flora mit *Nyssa aquatica* (Wasser-Tupelobaum) und *Taxodium* (Sumpfzypresse) nachgewiesen werden, die Feuchtstandorte anzeigt. Bohrungen südöstlich vom Bahnhof Rastatt sind im selben Niveau Mammutbäume stark vertreten. Weiter südlich, bei Sinzheim-Leiberstung, erreichen *Nyssa* bis zu 13% und *Taxodium* bis zu 53% an der Flora, die mit *Sciadopitys*, *Carya*, *Liquidambar*, *Aesculus* und *Ilex* weitere typisch pliozäne Taxa zeigt. Ähnlich hohe Werte vom *Taxodium*-Typ sind bisher an keiner anderen Stelle des Oberrheingrabens bekannt.

Rezent wachsen *Taxodium* und *Nyssa* zusammen in Feuchtgebieten und periodisch überfluteten Standorten in den Südstaaten der USA, am Mississippi-Delta und den Everglades in Florida. Im Tertiär waren Taxodium-Wälder im Niederrheingebiet verbreitet (→Braunkohle). Das über mindestens 15 km gemeinsame und dominante Vorkommen der beiden Arten deutet darauf hin, dass der fossile Boden das Relikt eines Sumpfzypressenwaldes darstellt.

Session 3 – Synchronisation and Dating of Proxy Records

The TephroMed project: Using tephra to precisely synchronising two key palaeoclimatic ICDP records of the eastern Mediterranean region

Kearney, Rebecca[1*]; Schwab, Markus J.[1]; Neugebauer, Ina[1]; Appelt, Oona[1]; Pickarski, Nadine[2] & Brauer, Achim[1]

[1] GFZ German Research Centre for Geosciences, Section Climate Dynamics and Landscape Evolution, Telegrafenberg, 14473 Potsdam, Germany

[2] University of Münster, Institute of Geology and Palaeontology-Palaeobotany, Heisenbergstr. 2, 48149 Münster, Germany

[*] Corresponding author: rebecca.kearney@gfz-potsdam.de

The eastern Mediterranean region is located between contrasting climatic zones and precipitation regimes, the humid Mediterranean climate to the north and the hyper-arid Saharo-Arabian desert belt to the south. Important sedimentary archives from lakes allow past hydroclimatic variability to be reconstructed using multiple proxies. However, problems associated with chronological uncertainty can prevent insight into regional climatic (a)synchronies. The application of using isochronous chronological markers of tephra (volcanic ash), both visible and non-visible (cryptotephra), can be a powerful tool in correlating palaeoclimatic records, particularly over vast distances.

The TephroMed project aims to precisely synchronise two important ICDP palaeoclimatic records from eastern Mediterranean through the use of tephrostratigraphic investigations: Lake Van in eastern Turkey (PALEOVAN, Litt et al., 2014) and The Dead Sea in Israel (DSDDP, Stein et al., 2011). Both records have undergone paleoenvironmental and climatic reconstructions which have indicated contrasting past regional responses to large-scale climatic events (e.g. Finne et al., 2019; Neugebauer et al., 2015). Though both records are dated through absolute and relative methods (radiocarbon, U-Th, varve counting, wiggle-matching), inherited large chronological uncertainties do not allow detailed insight into the potential climatic time-transgressive nature between the two sites. Yet, both records have tephra deposits within their lacustrine sediments, highlighting the potential to facilitate the alignment of both records using tephra (Neugebauer et al., 2021).

Here, we present new major and minor element volcanic glass chemical data from several tephra layers from both Lake Van and the Dead Sea ICDP cores. New geochemical data from fourteen selected visible tephra layers in Lake Van will be presented. In addition, preliminary cryptotephra results from the Dead Sea will be given, showing particular significant findings with volcanic glass derived from potentially several volcanic regions within the Mediterranean (e.g. Anatolia, Italy). With this new data, the results can help to facilitate a chronological alignment between Lake Van and the Dead Sea along with other important climatic archives in the Mediterranean. As a result of these findings, we can now start to answer questions associated with regional expression of past climatic events and their temporal transgression.

References

Finné, M., Woodbridge, J., Labuhn, I., Roberts, C.N., 2019. Holocene hydro-climatic variability in the Mediterranean: A synthetic multi-proxy reconstruction. Holocene 29(5), 847–863

Litt, T., Anselmetti, F.S., 2014. Lake Van deep drilling project PALEOVAN. Quat. Sci. Rev. 104, 1-7.

Neugebauer, I., Brauer, A., Schwab, M.J., Dulski, P., Frank, U., Hadzhiivanova, E., Kitagawa, H., Litt, T., Schiebel, V., Taha, N., Waldmann, N.D., DSDDP Scientific Party, 2015. Evidences for centennial dry periods at ~3300 and ~2800 cal. yr BP from micro-facies analyses of the Dead Sea sediments. Holocene 25, 1358-1371.

Neugebauer, I., Müller, D., Schwab, M.J., Blockley, S., Lane, C.S., Wulf, S., Appelt, O., Brauer, A., 2021. Cryptotephras in the Lateglacial ICDP Dead Sea sediment record and their implications for chronology. Boreas 50 (3), 844-861.

Stein, M., Ben-Avraham, Z., Goldstein, S.L., 2011. Dead Sea deep cores: A window into past climate and seismicity. Eos, Transactions American Geophysical Union 92, 453-454

Session 3 – Synchronisation and Dating of Proxy Records

Loess formation and chronology at the Palaeolithic key site Rheindahlen, Lower Rhine Embayment, Germany

Kehl, Martin[1*]; Seeger, Katharina[1]; Pötter, Stephan[2,3]; Schulte, Philipp[2]; Klasen, Nicole[1]; Zickel, Mirijam[1]; Pastoors, Andreas[4] & Claßen, Erich[5]

[1] Institute of Geography, University of Cologne, Cologne, Germany
[2] Chair of Physical Geography and Geoecology, RWTH Aachen University, Aachen, Germany
[3]Department Geography, University Koblenz-Landau, Koblenz, Germany
[4]Friedrich-Alexander-Universität Erlangen-Nürnberg, Institut für Ur- und Frühgeschichte, Erlangen, Germany
[5] LVR-Amt für Bodendenkmalpflege im Rheinland, Bonn, Germany
[*] Corresponding author: kehlm@uni-koeln.de

The former brickyard of Rheindahlen is a key-site for loess stratigraphy and human occupation of the Middle to Upper Pleistocene in the Rhineland. Besides a detailed loess-paleosol sequence (LPS), the site contains a unique stratified record of several Palaeolithic find horizons, rarely found in open-air sites. The chronostratigraphic framework including the age of Palaeolithic layers have been subject of debate (e.g., Schirmer, 2002, Richter, 2016). We revisited one of the previously described loess profiles of the site to provide new data for a re-evaluation of loess formation and chronostratigraphy aiming to improve our understanding of the Palaeolithic occupation.

Grain size, sediment color and micromorphological properties provide detailed records of the c. 7 m thick sequence showing three Bt horizons and a less strongly developed paleosol separated by brownish to light yellow or even white loess layers. The top of the sequence consists of a former plough horizon and a young layer of soil-derived colluvium accumulated during the Late Holocene and covering the modern Bt horizon, which has formed in loess reworked during the Lateglacial as determined by two luminescence ages on quartz. The modern Bt is less strongly developed than the Erkelenz Bt exposed at c. 3 m depth, does not show any features of frost and is not divided into two genetically distinct horizons as assumed before (Schirmer, 2002). Our datings on quartz and feldspar minerals suggest that loess layers in between the modern and the Erkelenz soils accumulated during the Last Glacial. These and the underlying loess layers and paleosol horizons show abundant features of frost, testifying to syngenetic or postdepostional changes under periglacial climate. Loess samples from below the Erkelenz soil did not give an increase in feldspar ages with depth, likely due to approaching field saturation of the luminescence signal. Micromorphological results show that the lowermost part of the sequence including a paleosol denominated as either Bt or Bw horizon by the various investigators of the sequence is characterized by clay illuviation from the overlying Bt horizon of the Rheindahlen soil and should be considered as a polygenetic soil, not necessarily representing a “true interglacial”.

In conclusion, correlation of the upper part of the Rheindahlen LPS with the Penultimate Glacial (“Wetterau-Löss”, “Gilgau-Löss”, Schirmer 2002, 2016) is rejected and formation of the Erkelenz soil during marine isotope stage 7 unlikely. The age of the Rheindahlen Bt and underlying loess layers remains open. Correlation of our results with the general stratigraphy of the Rheindahlen site does not elucidate the timing of human occupation testified by archaeological layers B3, B4/5, C1, and D1, but strongly corroborates to place the Middle Palaeolithic inventories of layers A3 and B1/B2 into the Last Glacial as expected based on typological criteria.

References

Richter, J., 2016. Leave at the height of the party: A critical review of the Middle Paleolithic in Western Central Europe from its beginnings to its rapid decline. Quat. Int. 411, 107-128.

Schirmer, W., 2002, Hrsg. Lösse und Böden in Rheindahlen. - GeoArchaeoRhein, 5, 13-27.

Schirmer, W., 2016. Late Pleistocene loess of the Lower Rhine. Quat. Int. 411, 44-61.

Session 1 – Climate variability and warmer climates

A centennial-scale-resolution record of climate and ecosystem variability in Central Europe during the past 130 kyrs from Füramoos, southern Germany

Kern, Oliver A.[1*]; **Koutsodendris, Andreas[1]**; Allstädt, Frederik[1]; Mächtle, Bertil[2] & Pross, Jörg[1]

[1] Institute of Earth Sciences, Heidelberg University, Im Neuenheimer Feld 234–236, 69120 Heidelberg, Germany
[2] Institute of Geography, Heidelberg University, Im Neuenheimer Feld 348, 69120 Heidelberg, Germany
[*]Corresponding author: oliver.kern@geow.uni-heidelberg.de

Deciphering the response of Central European vegetation to short-term climate forcing during the Late Pleistocene – and notably the Last Glacial – has long remained difficult owing to a general scarcity of continuous archives and a lack of temporally highly resolved datasets from North of the Alps. Here we present a new, highly resolved (mean resolution: 230 yrs) and near-continuous pollen record derived from drillcores from the Füramoos peat bog, southern Germany, to improve the understanding of the impact of short-term climate variability on ecosystems in Central Europe during the past 130 ka (Kern et al., 2022). This record represents the yet most complete, temporally highest resolved reconstruction of terrestrial ecosystem dynamics in Central Europe for the Last Glacial period. Our pollen data are augmented by X-ray fluoresence (XRF) core-scanning elemental data in decadal-scale resolution. The chronology of the record is based on on radiocarbon dating for the 0–45 ka BP interval and the tuning of marked changes in tree-pollen percentages at Füramoos to Mediterranean forest percentages in core MD95-2042 (Iberian margin; (Sánchez Goñi et al., 2008) for the 45–130 ka interval.

Our pollen data from Füramoos document highly dynamic vegetation change on different time scales during the past 130 kyrs. Temperate forests thrived during full interglacial conditions (i.e., during Marine Isotope Stages [MIS] 5e and 1), boreal forests developed during the early glaciation (MIS 5d–5a), and tundra vegetation prevailed during full glacial conditions of MIS 4–2. Importantly, 14 transient expansions (contractions) of tree and shrub populations are registered during the MIS 4–3 interval; these are synchronous with increases (decreases) in weathering intensity as documented in the XRF core-scanning data (K/Al) suggesting increases (decreases) in precipitation. Based on our chronology, these events can be firmly linked to specific Greenland Interstadials (Greenland Stadials) as documented in the NGRIP ice-core record (Rasmussen et al., 2014). Hence, our new dataset provides firm evidence that all Greenland Interstadials (Stadials) during MIS 4–3 left an imprint on Central European ecosystems north of the Alps. By extention, this indicates that the role of plant-migration lags in controlling vegetation dynamics in that region may have been previously overestimated, supporting the notion that glacial tree refugia must have existed around the alpine margins.

The comparison of individual expansions and contractions of tree and shrub populations at Füramoos during MIS 4–3 with NGRIP $\delta^{18}O_{ice}$ data and previously published North Atlantic sea-surface temperature (SST) data (core MD95-2036 – Bermuda Rise, Lehman et al. [2002]; core MD04-2845 – Bay of Biscay, Sánchez Goñi et al. [2008]) reveals that vegetation dynamics in Central Europe during interstadials of MIS 4–3 were closely linked to North Atlantic SST. During stadials, this climatic teleconnection weakened substantially, and a close connection with the climate variability recorded in Greenland prevailed. We attribute these patterns to changes in the strength of the Atlantic Meridional Overturning Circulation and associated latitudinal shifts of the polar front influencing the position of the Westerlies.

References

Kern, O.A., Koutsodendris, A., Allstädt, F.J., Mächtle, B., Peteet, D.M., Kalaitzidis, S., Christanis, K., Pross, J., 2022. A near-continuous record of climate and ecosystem variability in Central Europe during the past 130 kyrs (Marine Isotope Stages 5–1) from Füramoos, southern Germany. Quaternary Science Reviews 284, 107505.

Lehman, S.J., Sachs, J.P., Crotwell, A.M., Keigwin, L.D., Boyle, E.A., 2002. Relation of subtropical Atlantic temperature, high-latitude ice rafting, deep water formation, and European climate 130,000–60,000 years ago. Quaternary Science Reviews 21, 1917–1924.

Rasmussen, S.O., Bigler, M., Blockley, S.P., Blunier, T., Buchardt, S.L., Clausen, H.B., Cvijanovic, I., Dahl-Jensen, D., Johnsen, S.J., Fischer, H., Gkinis, V., Guillevic, M., Hoek, W.Z., Lowe, J.J., Pedro, J.B., Popp, T., Seierstad, I.K., Steffensen, J.P., Svensson, A.M., Vallelonga, P., Vinther, B.M., Walker, M.J.C., Wheatley, J.J., Winstrup, M., 2014. A stratigraphic framework for abrupt climatic changes during the Last Glacial period based on three synchronized Greenland ice-core records: refining and extending the INTIMATE event stratigraphy. Quaternary Science Reviews 106, 14–28.

Sánchez Goñi, M.F., Eynaud, F., Turon, J.L., Shackleton, N.J., 1999. High resolution palynological record off the Iberian margin: direct land-sea correlation for the Last Interglacial complex. Earth and Planetary Science Letters 171, 123–137.

Sánchez Goñi, M.F., Landais, A., Fletcher, W.J., Naughton, F., Desprat, S., Duprat, J., 2008. Contrasting impacts of Dansgaard–Oeschger events over a western European latitudinal transect modulated by orbital parameters. Quaternary Science Reviews 27, 1136–1151.

Session 2 – Abrupt Climate Change and Extreme Events

Sub-decadal scale environmental responses to hydro-climatic changes in the Middle Atlas Mountains, Morocco – learning from historical sources and a high-resolution multi-proxy lake sediment record

Kertscher, **Cathleen[1]***; Schmidt, Johannes[1]; Schneider, Birgit[1]; Köhler, Anne[1]; Dietze, Elisabeth[2]; Benkkadour, Abdelfattah[3]; Mikdad, Abdeslam[4]; Werther, Lukas[5]; Bolland, Alexander [1]; Pichat, Sylvain[6,7]; Fletcher, William[8]; Mischke, Steffen[9] & Zielhofer, Christoph[1]

[1] Physical Geography, Institute of Geography, Leipzig University, Leipzig, Germany
[2] Landscape Geoscience, Faculty of Geoscience and Geography, Georg-August-University Göttingen, Göttingen
[3] Department of Earth Sciences - Cadi Ayyad University, Marrakech, Morocco
[4] Institut National des Sciences de l'Archéologie et du Patrimoine, Rabat, Morocco
[5] Department for Medieval Archaeology, University of Tübingen, Tübingen, Germany
[6] Laboratoire de Geologie de Lyon (LGL-TPE), University of Lyon, Lyon, France
[7] Climate Geochemistry, Max Planck Institute for Chemistry, Mainz, Germany
[8] Department of Geography, Scholl of Environment, Education and Development, University of Manchester, Manchester, United Kingdom
[9] School of Engineering and Natural Sciences, University of Iceland, Reykjavik, Iceland
* Corresponding author: cathleen.kertscher@uni-leipzig.de

The Western Mediterranean region including the North African desert margin faces major environmental challenges in the context of global climate change in terms of rising temperatures, a higher recurrence of drought events and a decrease in annual precipitation. Additionally, human activities have significantly altered the montane landscape over the past century through deforestation and agricultural practices.

As a condition to state further prospects, it is crucial to comprehend past and present hydro-climatic patterns and their geo-ecological impact. The Moroccan Middle Atlas is considered a transition zone between the Atlantic, Mediterranean, and Saharan air masses, and is therefore of unprecedented interest in order to comprehend regional climate variability and to assess emerging hydrological, geomorphological and ecological impacts.

Despite the growing number of limnological studies from the Middle Atlas, there still is a strong need for coupling palaeolimnological results at the sub-recent time scale with historical cartographic information, meteorological data, and underlying climatic forcing. Lake Sidi Ali (33°03’ N, 5°00’ W, 2080 m a.s.l.) provides a unique archive for understanding environmental changes throughout the 20th century. At least during the past 100 years, the lake has experienced at least three significant lake-level changes in the order of several meters. We were able to reconstruct and semi-quantify these alternations with the help of historical sources,

topographic maps, and satellite imagery. In addition, we implemented a multi-proxy analytical approach on a 145-cm long sediment record, including pollen, $\delta^{18}O$ and $\delta^{13}C$ analysis of ostracod shells and CNS elemental analysis. A reliable age model based on 25 ^{210}Pb measurements and one radiocarbon dated cedar needle enables the correlation of sediment geochemical variations to lake-level changes.

We examined meteorological precipitation and temperature data to evaluate their influence on these fluctuations. Furthermore, we have indications for a temporal coupling of Atlantic climate patterns (North Atlantic Oscillation, NAO; Atlantic Multidecadal Oscillation, AMO) with Sidi Ali’s lake-level variations and we provide a more detailed insight into the responsiveness of local vegetation to the climatic and anthropogenic changes of recent decades. This study will thus help to better elucidate the interactions of lake hydrology and vegetation response to future environmental change.

Session 1 – Climate variability and warmer climates

Fake Science vs. Science beim Klimawandel: Die paläoklimatologische Sicht

Kleber, Arno[1*]; Richter-Krautz, Jana[1,2]

[1] Technische Universität Dresden, Institut für Geographie
[2] 101. OS, Dresden
[*] Kontakt: arno.kleber@tu-dresden.de

Im Themenbereich der Anthropogenen Globalen Erwärmung (AGE) stehen Argumente der Negation oder Skepsis den etablierten wissenschaftlichen Erkenntnissen oft diametral entgegen. Da sich insbesondere die Leugnung der AGE fast immer an eine breite Öffentlichkeit und nicht an die wissenschaftliche Community wendet, sind in letzterer die dabei aufgeworfenen Behauptungen teilweise kaum oder nur fragmentarisch bekannt. Viele der Argumente stammen jedoch aus dem Bereich der Paläoklimatologie, und deshalb wird der Vortrag die populärsten davon aufgreifen und ihre wissenschaftliche Validität diskutieren.

Folgende Behauptungen stehen dabei im Mittelpunkt:

- Das Klima hat sich schon immer geändert, das widerlegt einen anthropogenen Einfluss
- Früher war es schon viel wärmer, z.B. während der mittelalterlichen Warmzeit, als Wikinger Grönland besiedelten
- Die Rekonstruktion vergangener CO_2-Konzentrationen der Atmosphäre ist fehlerhaft
- Die CO_2-Konzentration ändert sich erst nach einer Erwärmung, kann also nicht deren Ursache sein (Fig. 1)
- Es gibt gemäß paläoklimatologischer Erkenntnisse keinen statistischen Zusammenhang zwischen CO_2-Konzentration und Temperatur (Fig. 1)
- Der „Hockey Stick“ ist eine Erfindung
- Temperaturmessdaten sind manipuliert worden

Literatur

Kleber, A., Richter-Krautz, J., 2022. Klimawandel FAQs - Fake News erkennen, Argumente verstehen, qualitativ antworten. Springer, https://doi.org/10.1007/978-3-662-64548-2.

Plimer, I., 2010. Heaven & Earth: global warming, the missing science. Choice Reviews Online 47:4435, https://doi.org/10.5860/choice.47-4435.

Stallinga, P., Khmelinskii, I., 2018. Phase relation between global temperature & atmospheric carbon dioxide. https://arxiv.org/pdf/1311.2165.pdf. Letzter Zugrif: 13.01.2021

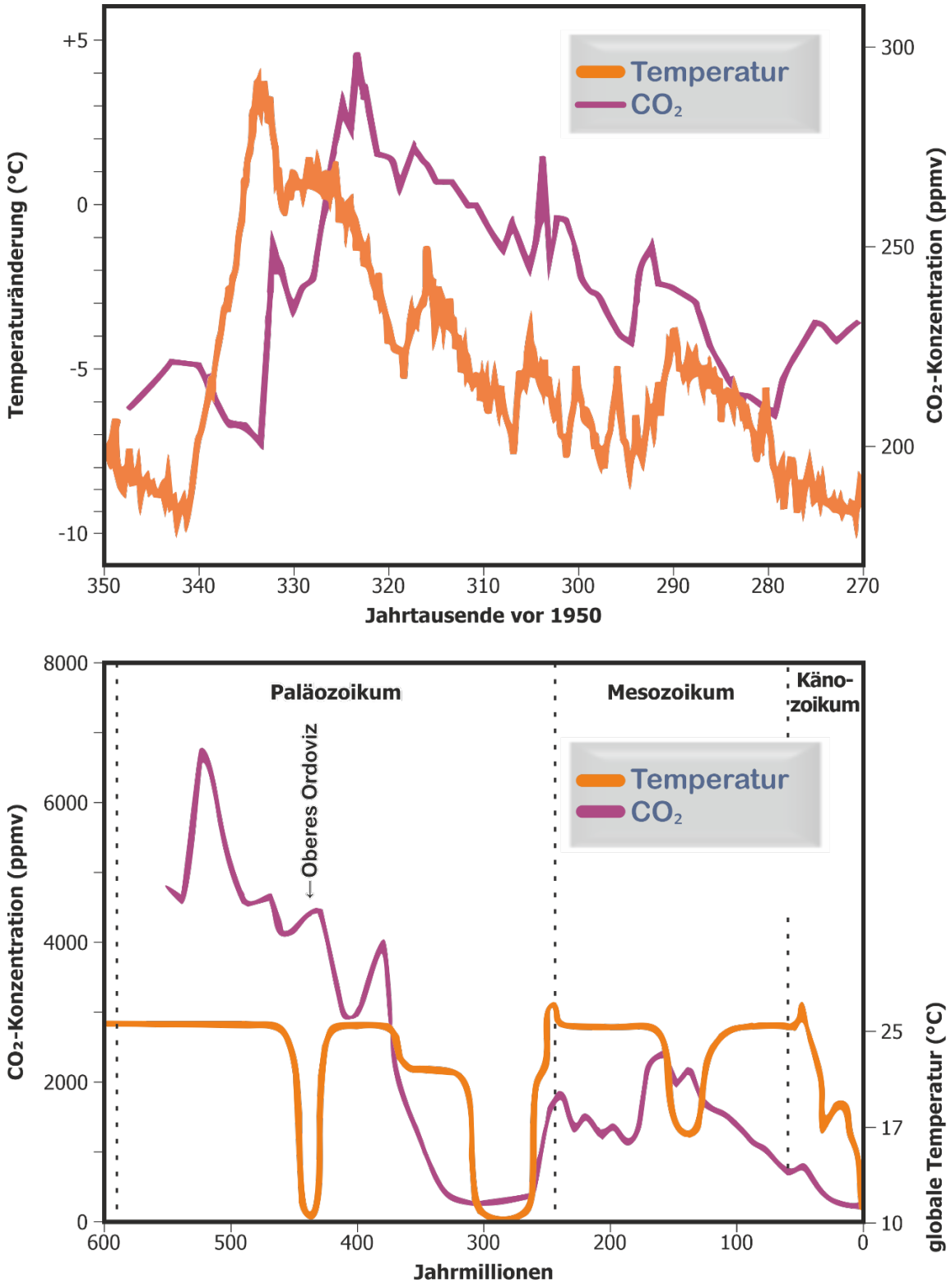

Fig. 1 oben: *Die zeitliche Beziehung zwischen Temperaturänderung und Änderung der CO_2-Konzentrationen (gemessen an im Eis eingeschlossener Luft) für einen Zeitraum vor ungefähr 300.000 Jahren, gewonnen aus einem Eisbohrkern in der Antarktis (Stallinga & Khmelinskii 2018).*

unten: *„Hieb-Graphik“: Beziehung zwischen Temperatur (Schätzungen durch Scotese) und CO_2-Konzentrationen (Ergebnis der Modellierung mit dem Globalen Atmosphärenzirkulationsmodell GeoCarb III, Berner & Kothavala 2001) für ca. 550 Millionen Jahre der Erdgeschichte (Plimer 2009 nach Hieb).*

Abbildung aus Kleber & Richter-Krautz (2022), verändert.

Session 1 – Climate variability and warmer climates

Multi-Proxy analyses and luminescence dating of Pleistocene deposits of former Lake Aschersleben (Saxony-Anhalt, Germany)

Klinger, Aileen[1*]; Endtmann, Elisabeth[2]; Frenzel, Peter[3]; Jöris, Olaf[4]; Lauer, Tobias[5]; Rappsilber, Ivo[2]; Rother, Henrik[2]; Vött, Andreas[1]; Wansa, Stefan[2]; Wollmeiner, Jana[3] & Fischer, Peter[1]

[1]Johannes-Gutenberg-University Mainz, Institute of Geography, Mainz
[2] Landesamt für Geologie und Bergwesen, Halle
[3] Friedrich-Schiller-University Jena, Institute of Geosciences, Jena
[4]MONREPOS Archaeological Research Centre and Museum for Human Behavioural Evolution, Neuwied, Germany
[5]University of Tübingen, Department of Geosciences, Tübingen, Germany
* Corresponding author: aklinger@students.uni-mainz.de

From the 1960s until the early 1990s, 20-25 m thick Pleistocene deposits of former Lake Aschersleben were exposed in the today flooded open cast lignite mines of Königsaue and Nachterstedt, providing the most complete Upper Pleistocene sequence of the Northern European Plain (Mania & Toepfer 1973). Combining sections from Schadeleben and Königsaue, Mania documented a series of thirteen depositional cycles, each comprised of alternating limnic, fluvial and periglacial sediments, covering the period from the end of the penultimate glaciation into the Holocene (e.g. Mania 2002; cf. Jöris 2004; Picin 2016). These cycles correlate at high resolution with the patterns of climatic changes known from Greenland Ice Core archives and marine records, implying that climatic events were rather synchronous across the North Atlantic region. Of further interest are three Middle Palaeolithic horizons that were excavated at Königsaue, representing repeated occupation of the former lake shore (Mania & Toepfer 1973). The site is a key for understanding late Neanderthal adaptation to northern European environments, the chronology, and behavior.

Against this background, following initial geophysical surveys, in October 2020 two parallel ~14.5m long cores were drilled at the edge of today’s Lake Concordia south of Schadeleben. Targeting at an improved understanding of the depositional contexts of the sequence, geoelectrical and *in situ* Direct Push-measurements, sedimentological and geochemical analysis as well as luminescence dating, pollen and ostracod analysis have been implemented. The two cores are largely characterized by the deposition of sands and silts in a predominantly fluvial regime, intercalated with intervals of limnic deposition. First luminescence dating results indicate that the sequence spans from MIS 6 until MIS 3/2, with highest accumulation rates during MIS 4 and at the transition to MIS 3. Botanical and micro-faunal evidence (Tertiary palynomorphs and dinoflagellate cysts) highlight the mixture of autochthonous and allochthonous components through large parts of the record. Overall, pollen concentrations are low, and deposits of clear interglacial pollen signature have not been detected whereas ostracod frequencies and species diversity hint at interglacial conditions at 12-14m depth. More specifically, the presence of *Cyprideis torosa*, found in this part of the sequence, indicates the existence of a permanent and shallow oligohalineous water body at a time of increased subrosion of the bedrock. The marked differences of our new record to the sequence at Königsaue will need to be addressed to understand meso-scale changes in landscape evolution in the Northern European Lowlands throughout the last Interglacial-Glacial Cycle.

References

Jöris, O. 2004. Zur chronostratigraphischen Stellung der spätmittelpaläolithischen Keilmessergruppen. Der Versuch einer kulturgeographischen Abgrenzung einer mittelpaläolithischen Formengruppe in ihrem europäischen Kontext. Berichte der Römisch-Germanischen Kommission 84, 49–153.

Mania, D. 2002. Der mittelpaläolithische Lagerplatz am Aschersiebener See bei Königsaue (Nordharzvorland). Praehistoria Thuringica 8, 16–75.

Mania, D., Toepfer, V. 1973. Königsaue. Gliederung, Ökologie und mittelpaläolithische Funde der letzten Eiszeit. VEB Deutscher Verlag der Wissenschaften.

Picin, A. 2016. Short-term occupations at the lakeshore: a technological reassessment of the open–air site Königsaue (Germany). Kurze Aufenthalte am Seeufer: eine technologische Neubetrachtung der Freilandfundstelle Königsaue (Deutschland). Quartär 63, 7–32.

Session 5 – Earth Surface Processes and Environmental Change

Landslide hazards in a changing alpine environment – the key role of lakes

Knapp, Sibylle[1*]

[1] Landslide Research Group, Technical University of Munich, Munich, Germany
[*] Corresponding author: sibylle.knapp@tum.de

Climate warming leads to a drastic change of the alpine landscape. Mountain glaciers are shrinking rapidly, and mountain flanks are being destabilized by degrading permafrost and de-buttressing by glacier retreat. Many new (meltwalter-) lakes will likely form right at the foot of unstable steep rock walls. Especially Lateglacial and Holocene rock-slope failures often occur progressively in multiple stages from the same or adjacent scarps because of paraglacial adjustment and stress adaptation. When impacting lakes, they have a high hazard potential due to impact waves and outburst floods with highly fluidized rock material. With that, the chance of rock-slope failures impacting lakes is increasing. Deciphering frequency, magnitude and secondary effects of such scenarios is therefore essential. But recurrence rates of catastrophic landslides are often unknown in subaerial deposits, where younger deposits cover or displace older ones.

Lake sediments enjoy a high reputation for studying environmental changes, flood chronologies or, for example, seismic tremors. Their sediment archives with a continuous record act as natural chronometers. Here, the key role of lakes in the alpine environment becomes clear: On the one hand, lakes are related to multi hazards, as outlined above. On the other hand, lakes can provide a setting to resolve repeated landslide activity in time and space and help to refine recurrence rates and magnitudes of mass movements on land.

Examples from recent case studies in the European Alps with a focus on large rock-slope failures, and other types of landslides, such as debris flows, will visualize remarkable outcomes of a complementary method approach. Geophysical, sedimentological, geomorphological and dating techniques are combined in order to bridge scales and to connect terrestrial and lacustrine archives. This concept highlights the potential of lakes for the reconstruction of subaerial mass movements that entered the lake, which is so far underestimated.

Fig. 1: *Connecting terrestrial and lacustrine archives allows for deciphering landslides in frequency, magnitude and secondary effects, e.g. at Lake Oeschinen/Kandersteg (CH), Lake Eibsee/Mount Zugspitze (D), and Flims (CH).*

Session 5 – Earth Surface Processes and Environmental Change

Chronology of river terrace formation in the Baza/Guadix Basin, Spain

Kögler, Laura[1*]; Wolf, Daniel[2]; Kolb, Thomas[1]; Faust, Dominik[2] & Fuchs, Markus[1]

[1] Justus Liebig University Giessen, Department of Geography, 35390 Giessen, Germany
[2] TU Dresden, Department of Geography, 01062 Dresden, Germany
[*] Corresponding author: Laura.Koegler@geogr.uni-giessen.de

The primary objective of the project is to approximate the velocities of backward erosion and river incision over long periods of time by applying a new conceptual dating approach in the 6000 km^2 large Baza/ Guadix Basin in north-eastern Andalusia.

Before its capturing by local rivers, the Baza/Guadix Basin was a wide-spread, runoff-free depression (endorheic basin). Starting in the Pliocene and persisting until the late Pleistocene, sediments of all grain sizes from the surrounding mountains were transported into the basin (Gibert et al. 2007). This vast endorheic basin was captured by a source river of the Rio Guadalquivir, which has cut into the original basin sediments to a depth of 300 meters (exorheic phase). Assumptions for the onset of the capturing vary from 1000 ka (Gibert et al. 2007) to only 43 ka (Perez-Peña et al. 2009). According to our own prospections, the determined erosion activity suggests a starting point for the capturing between 800 ka and 450 ka. The terrace sediments indicate highly variable and dynamic fluvial activities ever since the capturing of the basin. The terrace deposits as well as the tufa and travertine formations found in the project region have not yet been systematically documented and mapped. The travertine and sinter formations of the Basin are important, as they were formed after the respective fluvial incision and thus offer an excellent possibility of coupling these travertines and sinters with fluvial terrace deposits. Furthermore, tectonic activities played an important role both, for the depositional conditions during the endorheic phase (Haberland et al. 2017) and for the erosional processes in the subsequent exorheic phase (Garcia-Tortosa et al. 2011).

Important questions arise from this primary objective, which can be divided into two groups: questions referring to geomorphological issues (including tectonics) and questions concerning geochronological challenges. Two complementary dating methods will be applied on the valley fillings:

In order to determine the ages of sediments originating from the different fluvial terrace levels, various methods of luminescence dating approaches will be applied:

- For the younger terrace levels quartz and feldspar-based measurement protocols will be used.

- For the older fluvial deposits, only innovative methods of infrared stimulated luminescence (IRSL) and an enhanced IR radiofluorescence (IR-RF) protocol will be applied.

The tufa and calcareous sinter formations (including travertines) will be dated using the U/Th-method.

The Baza/Guadix Basin is an excellent study area, since the formerly endorheic basin was captured at the beginning of the Middle Pleistocene, resulting in a new drainage system to be established in the basin. The project will focus on the chronology and on the processes related to the evolution of this newly established system by characterizing fluvial erosion processes in the research area after the capturing event.

This poster gives an overview on different project goals and methods involved. Moreover, some first geochronological results shall be presented.

References

García-Tortosa, FJ., Alfaro, P., Sanz de Galdeano, C., Galindo-Zaldívar, J. (2011): Glacis geometry as a geomor-phic marker of recent tectonics: The Guadix-Baza basin (South Spain). - Geomorphology 125: 517 – 529.

Gibert, L., Scott, G., Martin, R., Gibert, J. (2007): The Early to Middle Pleistocene boundary in the Baza Basin (Spain). - Quaternary Science Reviews (QSR) 26: 2067 – 2089.

Haberland, C., Gibert, L., Jurado MJ., Stiller, M., Baumann-Wilke, M., Scott, G., Mertz, DF. (2017): Architecture and tec tono-stratigraphic evolution of the intramontane Baza-Basin (Bétics, SE-Spain): Constraints from seismic imaging. - Tectonophysics 709: 69 – 84.

Pérez-Peña, JV., Azañón, JM., Azor, A., Tuccemei, P., Seta, M., Soligo, M. (2009): Quaternary landscape evolution and erosion rates for a Neogene basin (Baza-Basin, SE Spain). - Geomorphology 106: 206 – 218.

Session 2 – Abrupt Climate Change and Extreme Events

Extreme flood events and pre-modern flood-protection – The St. Mary Magdalene´s flood of 1342 and the subsequent straightening of the Danube near Straubing, Lower Bavaria

Köhler, Anne[1,*]; Bauch, Martin[2]; Schneider, Birgit[1]; Berg, Stefanie[3]; Werban, Ulrike[4]; Pohle Marco[4] & Zielhofer, Christoph[1]

[1] Leipzig University, Institute for Geography, Leipzig, Germany
[2] GWZO Leibniz Institute for the History and Culture of Eastern Europe, Department Human and Environment, Leipzig, Germany
[3] Bavarian State Department for Cultural Heritage (BLfD), Munich, Germany
[4] Helmholtz Centre for Environmental Research – UFZ, Department Monitoring & Exploration Technologies, Leipzig, Germany
[*] Corresponding author: anne.koehler@uni-leipzig.de

Floodplains are global focal points of human impact and highly sensitive socio-ecological mechanisms of action. They are particularly dynamic landscapes and key zones of cultural and natural heritage. Fluvial societies have radically and fundamentally changed Central European floodplains because of their exceptionally high diversity of use and the associated strategies of land reclamation and risk management. We specifically focused on the historical and geomorphological reappraisal of the Danube's flood dynamics and its impact on floodplain landscapes and human interactions. According to historical scources, after the St. Mary Magdalene's flood in July 1342, there is evidence of massive water engineering work in the vicinity of the Oberalteich monastery near Straubing between 1344 and 1355. This led to the first known straightening of the Danube over a length of several kilometres. This massive intervention in the floodplain of the Danube, which might still shape the course of the Danube in the region today, has been less analysed so far. A historical-archaeological investigation as well as a geoscientific investigation of the Danube floodplain between Reibersdorf and Bogen would be appropriate in order to be able to place the human-environment interaction in this region in the late Middle Ages in a broader chronological context.

We want to detect and characterise the flood sediments, to clearly localise the Danube straightening at Oberalteich for the first time, to quantify the earthworks and to place them in the fluvial-geomorphological context of the Holocene floodplain history.

On this poster we want to present our first results of the geomorphological prospection in the floodplain using different geophysical methods (electro-magnetic induction, ERT), direct-push sensing and driving core drillings.

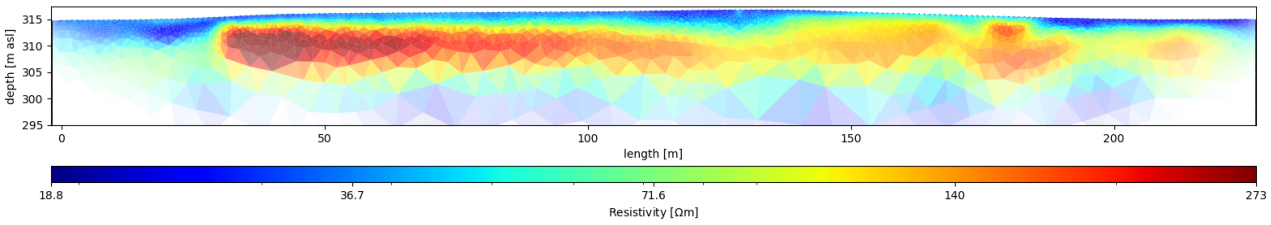

Fig. 1: *ERT cross-section of Danube floodplain with different Holocene terraces and lithostratigraphical units.*

Session 1 – Climate variability and warmer climates

Climate and ecosystem variability in SE Europe since the Early Pleistocene: The Tenaghi Philippon archive revisited

Koutsodendris, Andreas[1*] & Pross, Jörg[1]

[1] Heidelberg University, Institute of Earth Sciences, Heidelberg, Germany
* Corresponding author: andreas.koutsodendris@geow.uni-heidelberg.de

The limnotelmatic sequence of Tenaghi Philippon (NE Greece) has been recognized since the 1960’s as a unique archive of terrestrial climate and ecosystem dynamics for the Quaternary in Europe. Based on a new 200-m-long sediment core from Tenaghi Philippon (Pross et al. 2015) that spans the past c. 1.35 Ma continuously, we have generated a new pollen-based record of Mediterranean ecosystem dynamics at (sub-)centennial temporal resolution (mean: c. 250 years) across the past ten glacial-interglacial cycles (from Marine Isotope Stage [MIS] 1 through MIS 21). The vegetation data are augmented by decadal-scale resolution (c. 30 years) XRF-based element geochemical data that provide insight into precipitation variability. Age control is based on the integration of radiocarbon dating, tephrochronology, magnetostratigraphy, and orbital tuning. The exceptionally high temporal resolution of our datasets and the high-quality age control allow reconstruction of the vegetation response to climatic forcing at time scales that are comparable to the rapidity of present-day and near-future anthropogenic climate change. Our analysis documents two stable vegetation regimes across a wide range of moisture levels, with abrupt shifts from forest to steppe biomes occurring when a threshold in precipitation was crossed. Notably, our results demonstrate that the demise of Mediterranean forests occurred within decades, and hence, they concretise the vulnerability of Mediterranean forests to the recurring droughts as they are projected for the Mediterranean region in the near future. Our results highlight the potential of the new, highly resolved pollen record from Tenaghi Philippon to serve as a proxy-based template for short-term climate and terrestrial ecosystem dynamics in the northern hemisphere throughout the past c. 870 ka.

References

Pross, J., Koutsodendris, A., Christanis, K., Fischer, T., Fletcher, W.J., Hardiman, M., Kalaitzidis, S., Knipping, M., Kotthoff, U., Milner, A.M., Müller, U.C., Schmiedl, G., Siavalas, G., Tzedakis, P.C., Wulf, S., 2015. The 1.3-Ma-long terrestrial climate archive of Tenaghi Philippon, northeastern Greece: Evolution, exploration and perspectives for future research. Newsletters on Stratigraphy 48, 253-276.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Multi-archive reseach for intertwined environmental and historic reconstruction of Bad Waldsee since medieval times

Krahn, Kim J.[1*]; Haas, Kristin[2]; Lemmes, Claudia[3]; Saeidi Ghavi Andam, Sara[4]; Gigl, Florian[5]; Hinderer, Matthias[2]; Hirbodian, Sigrid[3]; Hollert, Henner[5]; Marinova, Elena[4]; Nelle, Oliver[4]; Rösch, Manfred[4]; Rückert, Peter[6]; Plessen, Birgit[7]; Tjallingii, Rik[7]; Wick, Lucia[4,8] & Schwalb, Antje[1]

[1] Institute of Geosystems and Bioindication, Technische Universität Braunschweig, Langer Kamp 19c, 38106 Braunschweig
[2] Institute of Applied Geosciences, Technische Universität Darmstadt, Schnittspahnstrasse 9, 64287 Darmstadt
[3] Institute of Historical Regional Studies and Auxiliary Sciences of History, University of Tübingen, Wilhelmstraße 36, 72074 Tübingen
[4] Landesamt für Denkmalpflege im Regierungspräsidium Stuttgart, Fischersteig 9, 78343 Gaienhofen-Hemmenhofen
[5] Department Evolutionary Ecology and Environmental Toxicology, Goethe University Frankfurt/Main, Max-von-Laue-Str. 13, 60438 Frankfurt/Main
[6] State Archives of Baden-Württemberg, Central State Archive Stuttgart, Konrad-Adenauer-Straße 4, D-70173 Stuttgart
[7] Helmholtz Centre Potsdam GFZ, Section Climate Dynamics and Landscape Evolution, Telegrafenberg, 14473 Potsdam
[8] Integrative Prehistory and Archaeological Sciences, University of Basel, Spalenring 145, 4055 Basel
[*] Corresponding author: k.krahn@tu-braunschweig.de

Paleolimological studies focusing on the last millemium in Europe often face the difficulty differentiating natural from anthropogenic signals and precisely evaluating causes and effects of environmental changes. Especially lakes close to urban settlements register long-term human alterations, partially back to the Neolithic period. To tackle this challenge, an interdisciplinary research team was established, combining expertise in paleoenvironmental, ecotoxicological and historical studies. Lake Stadtsee, a small euthropic lake located next to the medieval old town of Bad Waldsee (Southern Germany), offers an excellent environmental archive with its mostly seasonally laminated sediments, reaching back beyond the Iron Age. Numerous historical documents, maps, and stock books as well as local historical timber and modern reference trees with their dendrochronological information provide additional archives for reconstructing socio-economic developments and climatic change. The project aims to determine the effects of environmental changes on the population, evaluate how the history of a city and its periphery affected lake development and water quality, and gain fundamental knowledge on the resilience of aquatic ecosystems for the preindustrial phase of Bad Waldsee from AD 1200 to 1800. We focus on the response of the lake ecosystem to population and land use dynamics, war, industrial production, trade activity, climate change, and catastrophic events such as floods and fire.

First results clearly show an early impact of the local population on Lake Stadtsee and its catchment by increased nutrient supply visible in changes of the diatom assemblages towards hypereutraphentic species and a pollen record indicative of a permanent deforestation of the landscape in the period under consideration, even in times of economic crises and war. X-ray fluorescence (XRF) core scanning suggests varying lithozones. It is highly remarkable that the varves reach their maximum thickness during medieval times, demonstrating eutrophication of the lake and enhanced anthropogenic impact as well. Ecotoxicological tests proof the increased presence of substances with dioxin-like effectivities already in medievial times. Additionally, the inputs of persistent pollutants such as heavy metals and polycyclic aromatic hydrocarbons (PAHs) will be determined. Historical records for a diverse set of crafts, textile industry, as well as the trade of grains on a larger scale can be found and compared for the city of Waldsee, dating back to as early as the late Middle Ages. Currently, ^{14}C and ^{210}Pb datings are combined with a varve chronology to develop a robust age model which will allow for correlating sedimentary signals with historic documents precisely to the year and will ultimately enable a better understanding of natural and human impacts.

Fig. 1: *Coring of Lake Stadtsee in June 2021 next to the old town of Bad Waldsee (Foto: K. Krahn).*

Session 3 – Synchronisation and Dating of Proxy Records

Geochronological investigations at the Last Glacial Maximum of the Scandinavian Ice Sheet in NE-Germany

Krauß, Nikolas[1*]; Kenzler, Michael[1]; Lüthgens, Christopher [2] & Börner, Andreas [3]

[1] University of Greifswald, Institute of Geography and Geology, Greifswald, Germany
[2] University of Natural Resources and Life Sciences, Institute for Applied Geology, Vienna, Austria
[3] LUNG M-V, Geological Survey of Mecklenburg-Vorpommern, Güstrow, Germany
*Corresponding author: nikolas.krauss@uni-greifswald.de

Geomorphologic investigation and dating methods as Optically Stimulated Luminescence (OSL) or Surface Exposure Dating (SED) are the most applied methods in reconstruction and chronologically defining of ice marginal positions. Though there is an increase in the availability of geochronometrical data over the past decades, the progression, timing and even the number of oscillations of the Scandinavian Ice Sheet (SIS) during the Weichselian glaciation is still equivocal. Especially in the area of north-eastern Germany, there is a lack of numerical age data compared to other bordering states of the Baltic Sea (cf. Hughes et al. 2016). Recently evidence of an asynchronous ice margin (cf. Hardt 2017; Tylmann et al. 2019; Lüthgens et al. 2020) raised a new discussion about the dynamics of the SIS in its southern extent during the Last Glacial Maximum (LGM). Due to the topographic shape of the wider Baltic Sea Basin and disparities in regional climate, differences in ice stream velocities occurred, which led to a distinct large-scale lobate structure of the SIS. Within this context Lüthgens et al. (2020) introduced a model in which the Oder lobe advanced already during late Marine Isotope Stadium (MIS) 3 to its maximum position (local LGM) hitherto ascribed to the Brandenburg Phase of MIS 2. This model based amongst others on OSL age data from glacio-fluvial (sandur) deposits from the vicinity of the terminal moraines considered to correspond with the Weichselian maximum extent of the SIS.

In relation to this, we present a set of new OSL ages from the sandur area north-westerly of the Oder lobe. Analogue to the studies at the ice marginal position of the Oder lobe, we sampled sand pits revealing glacio-fluvial (sandur) deposits located in front of the ice marginal position of the Weichselian maximum extent of the SIS. Our study sites are considered to mark regional key positions in the reconstruction of the LGM in north-eastern Germany.

Based on the new age data set, we are aiming to correlate our results with previously published OSL and SED ages from ice marginal positions belonging either to MIS 3 or to MIS 2 in north-eastern Germany and Denmark. We contribute to a better understanding about the dynamics of the SIS at its south-western periphery during this time frame. Furthermore, we try to find more suitable locations and sediments, to verify the model of Lüthgens et al. (2020), depicting that the LGM in north-eastern Germany is asynchronous, with a late MIS 3 and a MIS 2 branch.

References

Hardt, J., 2017. Weichselian phases and ice dynamics of the Scandinavian Ice Sheet in Northeast Germany – A reassessment based on geochronological and geomorphological investigations in Brandenburg, Department of Geosciences, Freie Universität Berlin, Berlin.

Hughes et al. 2016. The last Eurasian ice sheets – a chronological database and time-slice reconstruction, DATED-1, Boreas, 45, 1–45.

Lüthgens C., Hardt J., Böse M., 2020. Proposing a new conceptual model for the reconstruction of ice dynamics in the SW sector of the Scandinavian Ice Sheet (SIS) based on the reinterpretation of published data and new evidence from optically stimulated luminescence (OSL) dating, E&G Quaternary Sci. J. 69, 201-223.

Tylmann et al., 2019. The Local Last Glacial Maximum of the southern Scandinavian Ice Sheet front: Cosmogenic nuclide dating of erratics in northern Poland, Quaternary Sci. Rev., 219, 36–46.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Fire, fungi and forage - tracing palaeolithic human-environmental interactions in sediments from the Nahe palaeolake (Schleswig-Holstein).

Krüger, Sascha[1]*; Walter Dörfler[2], Berit V. Eriksen[3]

[1] National Museum of Denmark, Environmental Archaeology and Materials Science, I. C. Modewegsvej, 2800 Kongens Lyngby, DK
[2] Institute of Prehistoric and Protohistoric Archaeology, Johanna-Mestorf-Straße 2-6, 24106 Kiel, D
[3] Centre for Baltic and Scandinavian Archaeology, Schleswig-Holstein State Museums Foundation Schloss Gottorf, Schlossinsel 1, 24837 Schleswig, D
* Corresponding author: sas@natmus.dk

Sediments from the Nahe palaeolake in Schleswig-Holstein provided a continuous and high-resolution palynological record in the vicinity of a Lateglacial (Ahrensburgian) archaeological site in northern Germany. The principal objective of the study was to investigate potential reflections of Palaeolithic human-environmental interaction, which is generally regarded as challenging. Charcoal particle frequencies in different size classes and coinciding fungal spores reveal a remarkable pattern at the transition from the Dryas 3 to the Preboreal period that corresponds to the chronological attribution of parts of the archaeological record. The applied indicators of human action render it possible to define a temporally limited phase of generally elevated large charcoal particle inputs, reflecting potentially anthropogenic activity. The interpretation of the palynological record leads to the hypothesis that the climatically driven rapid change of the vegetation at the Pleistocene-Holocene transition caused temporally increased hunting activities by Late Palaeolithic hunter-gatherers. The good age control of the record allowed to date this phase between 11,650 and 11,520 cal yr BP.

Fig. 1: *Sediments from the Nahe palaeolake – the first recorded partially laminated Lateglacial sequence from Schleswig-Holstein.*

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Charcoal or Biotite – the importance of minerals in the preparation and interpretation of Greenlandic palynological samples

Krüger, Sascha[1*], Schnetger, B.[2], Strunk, A[1]., Jessen, C.[1]

[1] National Museum of Denmark, Environmental Archaeology and Materials Science, I. C. Modewegsvej, 2800 Kongens Lyngby, Denmark
[2] Institute for Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky University of Oldenburg, Oldenburg, Germany
* Corresponding author: sas@natmus.dk

It is common practice to count charcoal particles alongside pollen and non-pollen palynomorphs (NPP’s) in palynological samples. The classification of material as charcoal is dependent upon a number of morphological criteria which, in certain geological zones, could be misclassified. In a preliminary study we tested the effects of three different preparation techniques on the count result of charcoal, pollen and NPP’s from the same samples of Greenland lake sediments. We demonstrate that the use of hydrofluoric acid has a major impact on the record of co-counted charcoal particles, while pollen and NPPs appeared to fluctuate only marginally, as expected. We show that detrital biotite is responsible for a large fraction of the particles misclassified as charcoal and suggest a way to minimize inaccuracy.

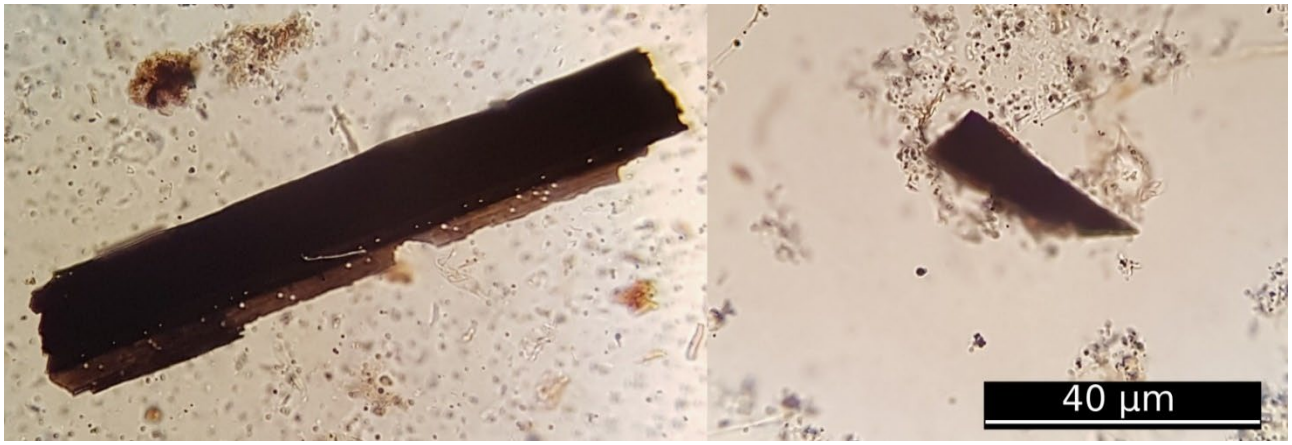

Fig. 1: *Appearance of charcoal particles (left) and detrital biotite (right) as seen through the microscope (400x magnification). A visual differentiation is often impossible.*

Session 5 – Earth Surface Processes and Environmental Change

Quaternary vega sediments and dune archives on the Eastern Canary Islands

Labahn, Jakob[1*]; Roettig, Christopher-B.[1]; Kolb, Thomas[2]; Pint, Anna[3]; Marburg, Carsten[1]; Menéndez, Inmaculada[4]; Zech, Michael[1] & Faust, Dominik[1]

[1] Dresden University of Technology, Institute for Geography, Dresden, Germany
[2] Justus-Liebig-University Gießen, Institute for Geography, Gießen, Germany
[3] University of Cologne, Geographical Institute, Cologne, Germany
[4] University Las Palmas de Gran Canaria, Institute for Oceanography and Global Change, Las Palmas de Gran Canaria, Spain
* Corresponding author: Jakob.Labahn@tu-dresden.de

So far mainly two different types of archives provide information about changes in Quaternary conditions on the Eastern Canary Islands: 1. Carbonate aeolianites and 2. so-called “Vega sediments”. The dune archives are built up by different generations of biogenic carbonate sands, intercalated by reddish silty layers. The carbonate sands are transported landwards, prograding from the shallow shelf around the islands, while the reddish silty layers are dominated by allochthonous dust material, originating from the northern African continent.

The Canary Islands are of volcanic origin. The development of the Eastern Canary Islands started with Cretaceous submarine volcanism followed by various periods of subaerial eruptions. Several valleys are formed within that basaltic bedrock. Later on, some of those valleys became dammed by later (Pleistocene) appearing volcanism. Because of such damming those valleys were filled up with sediments. The fillings of the dammed valleys are so called “vega sediments” (enriched in silt and clay). These “Vega sediments” give insight into soil sediments, transported from the surrounding slopes to the valley floor and about the accumulated dust material.

Following our assumptions both archive types (dunes and vegas) should complement each other. The dune archives store information about distinct dust dominated periods. But the the same time those archives are limited in giving insight into occurring dust accumulation during periods which are dominated by carbonate sand accumulation (and hence a dune environmental setting dominated by processes like reptation and saltation, which exclude a preservation of deposited silty dust).

On the other hand, vega sediment archives seem to preserve (more or less) continuously the dust deposits. Nevertheless, swelling and shrinking processes in those clay-enriched materials hamper a straightforward stratigraphic correlation. We assume that the combination of both archive types will allow a much more comprehensive interpretation of a suggested cyclicity of palaeo environmental conditions in the lower latitides. Finally, we hope to contribute to the understanding of the activity and influence of different potential source areas of the northern African continent.

Session 1 – Climate variability and warmer climates

Late Glacial and Holocene environmental change recorded at the gravel pit Niederweimar (Central Hesse)

Lomax, Johanna[1*]; Sauer, Daniela[2]; Shumilovskikh, Lyudmila[3]; Hoselmann, Christian[4] & Fuchs, Markus[1]

[1] Justus Liebig University Giessen, Department of Geography, Giessen, Germany
[2] University of Göttingen, Department of Physical Geography, Göttingen, Germany
[3] University of Göttingen, Department of Palynology and Climate Dynamics, Göttingen, Germany
[4] Hessian Agency for Nature Conservation, Environment and Geology, Wiesbaden, Germany
* Corresponding author: johanna.lomax@geogr.uni-giessen.de

The gravel pit Niederweimar offers a perfect opportunity to study Late Glacial environments. Overlying Pleistocene gravels, well stratified Late Glacial flood loams including the Laacher See tephra give witness to changing environments and fluvial dynamics (Fig 1). In Lomax et al. 2018, first results regarding chronology, palynology, grain sizes and heavy minerals of one section (NDW6) in the Niederweimar flood loams were presented. They revealed some inconsistencies in the chronology, especially regarding the luminescence ages. We therefore tried to refine the chronology by dating further samples of section NDW6 and of a second section (NDW3). The new luminescence ages confirm that OSL dating of the site is very challenging, due to highly variable water contents and due to volcanic quartz varieties with unwanted luminescence properties. The resulting chronology of the section is therefore mainly tied to seven ^{14}C ages, reaching from ca. 14,500 to 13,000 years cal BP and probably covering the interstadials Meiendorf, Bölling and Alleröd. Above the Late Glacial deposits, a layer of concentrated Laacher See tephra is present, which is overlain by sediment mixed with relocated tephra of several decimetres thickness. Holocene floodplain loams form the top of the sequence. Fluvial dynamics and environmental change from the Late Glacial to the Holocene are discussed, based on the palynological results, grain size analyses and element concentrations.

References

Lomax, J., Steup, R., Shumilovskikh, L.S., Hoselmann, C., Sauer, D., van Diedenhoven, V., Fuchs, M., 2018. Field Trip B (27 September 2018): Quaternary environments of Giessen and its surrounding areas. DEUQUA Special Publications 1, 15–28.

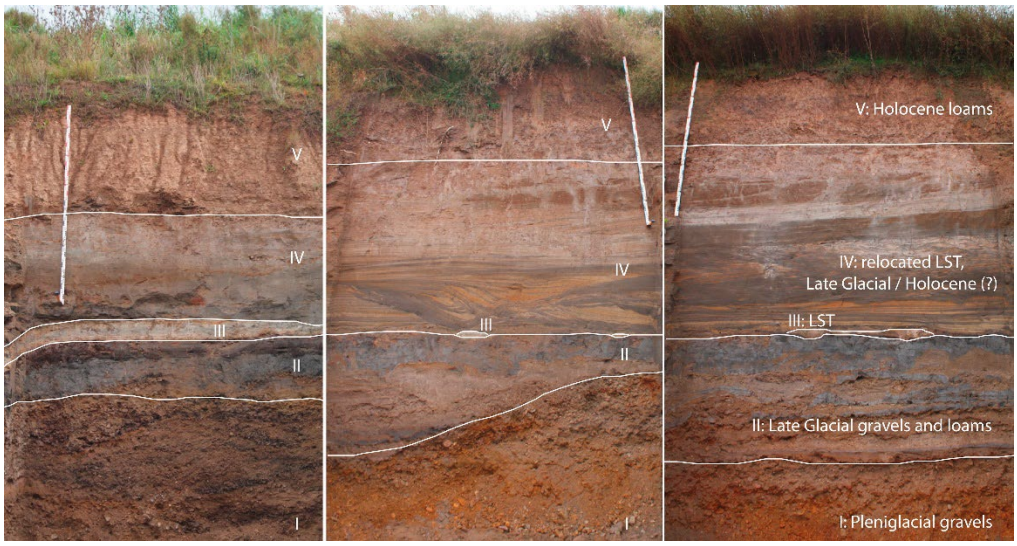

Fig. 1: *Three sections excavated at Niederweimar, showing the typical sequence of fluvial sediments from Pleniglacial gravels to Holocene floodplain loams. All sites include the Laacher See Tephra (LST), but with varying thickness and mostly fluvially relocated.*

Knowledge transfer

The Specialised Information Service for Geosciences (FID GEO): Supporting Open Access Publications for the Geosciences Community in Germany

Lorenz, Melanie[1*]; Elger, Kirsten[1]; Achterberg, Inke[2]; Semmler, Malte[2]; Meistring, Marcel[1] & Pfurr, Norbert[2]

[1] GFZ German Research Centre for Geosciences, Potsdam, Germany
[2] Göttingen State and University Library (SUB Göttingen), Göttingen, Germany
* Corresponding author: melorenz@gfz-potsdam.de

The shift towards Open Science practices is increasingly demanded by science policy. The transition to Open Access for text publications goes hand in hand with a growing demand to make data, scientific software and samples, freely and FAIRly available to the general public. A persistent problem here is the clear and permanent accessibility and re-usability of scientific publications. This development affects both the scientific publication culture as well as the information infrastructures and poses major challenges to the German-based geosciences community.

The specialized information service for geosciences (FID GEO) is a service funded by the German Research Foundation (DFG) and supports the cultural change towards Open Access publications. Hereby, FID GEO pursues a holistic approach to Open Science, including scientific literature, data, samples, and scientific software, and aims to promote their interconnection. FID GEO actively provides data and text publishing services through the affiliated repositories GFZ Data Services and GEO-LEOe-docs, as well as an on-demand digitization service of printed geoscientific literature and maps. The focus here is on the services and information systems that ensure permanently available and reliably citable publications of writings and data. Specifically, the service for text publications is provided in the FID GEOs own subject repository GEO-LEOe-docs. The affiliated research data repository GFZ Data Services is available for the publication of research data and scientific software from the earth and environmental sciences.

In addition, FID GEO aims to comprehensively inform the German-based geoscientific community about Open Science and FAIR data by bringing the discussions to the individual disciplines through various communication channels. To strengthen the open information culture in the geosciences, FID GEO collaborates with strategic (inter)national initiatives such as NFDI4Earth, COPDESS and OneGeochemistry.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Reconstructing past land use and cultural burning in the Amazon

Maezumi, Shira (Yoshi)*

Department of Archaeology, Max Planck Institute for Geoanthropology, 07745 Jena, Germany
*Corresponding author: shira.maezumi@gmail.com

Anthropogenic climate change combined with increased human-caused ignitions is leading to more frequent and more severe fires in the Amazon. Although modern human influence over Amazon is large, it is unknown how past human-environment interactions may have shaped vegetation composition and structure in key regions of the Amazon. Here, we use lake sediment cores and archaeological soil profiles from the Amazon to examine the history of Indigenous land use and cultural burning for the last 6,000 years. These records document a similar land use strategy across rainforest and seasonally dry forest-savanna ecosystems that implemented low-severity cultural burning, polyculture (multi-crop) cultivation, and agroforestry indicated by the enrichment of forests with edible plants. Cultural burning was a key component to the later formation of the nutrient-rich Amazonian Dark Earth (ADE) soils. The selective forest enrichment of edible plants and frequent low-severity cultural burning altered the composition and structure of forests growing on ADEs, making them more drought susceptible and fire-prone today. Rainforest burning and fire severity in the past

decade is higher than any other period in the record. This is attributed to combined climate and human factors which create optimal conditions for wildfires in ADE forests and threatens to transform the Amazon from a net carbon sink to a net carbon source. To help mitigate the occurrence of mega-fires, a fire management policy reducing fire-use and careful fire management for farming may help to reduce fuel loads and the occurrence of mega-fires in fire-prone ADE forests. As both natural and anthropogenic pressures are projected to increase in the Amazon, these data provide valuable insights into the legacy of past human land use and cultural burning on modern ADE forest composition, structure, and flammability that can inform ecological benchmarks and future management efforts in the Amazon.

Session 3 – Synchronisation and Dating of Proxy Records

Luminescence Dating of Rock Surfaces and Large Clast: A New Approach Towards Reconstructing Quaternary Climate and Sediment Dynamics

Marik, Madhurima*; Hofmann, Felix Martin; Fülling, Alexander; Heydari, Maryam; Mueller, Daniela & Preusser, Frank

Institute of Earth and Environmental Sciences, University of Freiburg, 79104 Freiburg, Germany
*Corresponding author: madhurima.marik@geologie.uni-freiburg.de

Keywords: Rock surface luminescence, depth dependent bleaching, Upper Rhine Graben

Luminescence dating has been applied to a wide range of geological applications within Quaternary research and also it has undergone several methodological amendments since early days. Rock surface luminescence dating is a recent advancement of this method that is now widely being used to overcome the general limitations of the traditional dating technique. The time of burial of rock surfaces can be dated by utilizing the dose dependent, light sensitive luminescence signal which accumulates in feldspar and quartz grains during burial. Exposure to daylight bleaches the luminescence signal in the rock surface grains within minutes to hours, and longer periods of exposure bleach the luminescence signal further into the rock (Sohbati et al., 2011, 2012b). Once the rock is buried, the dose accumulated in the bleached part of the rock increases due to radioactive decay and the dose remains intact in the rock after its burial according to Ageby et al., 2021. A long exposure period leaves a distinct bleaching record in the luminescence profile with depth into the rock surface which helps to enlighten the sediment transportation and bleaching history, and it may also be possible through this process to decipher multiple burial and exposure events.

The subsiding basin of Upper Rhine Graben (URG), located to the Northwest of the Alps between Basel and Frankfurt, acts as a major depocenter of erosional debris originating from the western Alps as well as from the Jura, the Black Forest and the Vosges mountains. Hence, the Upper Rhine Graben's Quaternary infill provides an ideal repository for reconstructing sediment dynamics in response to climatic change (Preusser et al., 2021). To reveal that history, this study proceeds towards deciphering a detail geochronology of URG deposition using luminescence dating. In a first case study, along with dating classic sand layers from that area, rock surface dating is carried out on cobbles and pebbles from one of the gravel pit deposit (Hartheim) within the graben area. The well-rounded cobbles and pebbles are supposed to have traveled long distances before their deposition and were hence likely bleached properly through sunlight. Furthermore, the sand dispersed into the gravel matrix is also to be tested through traditional luminescence dating.

References:

Ageby, L., Angelucci, D. E., Brill, D., Carrer, F., Rades, E. F., Rethemeyer, J., ... & Klasen, N. (2021). Rock surface IRSL dating of buried cobbles from an alpine dry-stone structure in Val di Sole, Italy. *Quaternary Geochronology*, *66*, 101212.

Preusser, F., Büschelberger, M., Kemna, H. A., Miocic, J., Mueller, D., & May, J. H. (2021). Exploring possible links between Quaternary aggradation in the Upper Rhine Graben and the glaciation history of northern Switzerland. *International Journal of Earth Sciences*, *110*(5), 1827-1846.

Sohbati, R., Murray, A. S., Chapot, M. S., Jain, M., & Pederson, J. (2012). Optically stimulated luminescence (OSL) as a chronometer for surface exposure dating. *Journal of Geophysical Research: Solid Earth*, *117*(B9).

Sohbati, R., Murray, A. S., Jain, M., Buylaert, J. P., & Thomsen, K. J. (2011). Investigating the resetting of OSL signals in rock surfaces. *Geochronometria*, *38*(3), 249-258.

Fig. 1: *Stepwise procedure of rock surface dating (one drilled metamorphic rock from the left, drill cores from the drilling process in the middle and very thin rock slices of ~0.8 mm thickness and ~7mm diameter at the right)*

Fig. 2: *An overview of the Hartheim gravel pit deposit (study area) located within the Upper Rhine graben area*.

Session 5 – Earth Surface Processes and Environmental Change

Responses of alluvial river networks to periodic environmental change: Linking stratigraphic and geomorphic archives

M^{c}Nab, Fergus[1*]; Schildgen, Taylor[1,2]; Turowski, Jens[1] & Wickert, Andrew[1,3,4]

[1] Helmholtz-Zentrum Potsdam, Deutsches GeoForschungsZentrum GFZ, Potsdam, Germany
[2] Institut für Geowissenschaften, Universität Potsdam, Potsdam, Germany
[3] Saint Anthony Falls Laboratory, University of Minnesota, Minneapolis, USA
[4] Department of Earth & Environmental Sciences, University of Minnesota, Minneapolis, USA
* Corresponding author: mcnab@gfz-potsdam.de

Alluvial river networks represent the primary way by which sediment is transported from erosional source regions to downstream basins. Their slopes, and the rates at which they transport sediment, are influenced by the rates at which they are supplied with sediment and water. Sediment and water supply are both sensitive to environmental factors such as temperature and precipitation rates. Thus, we expect stratigraphic records downstream of alluvial catchments, and fluvial terraces sequences along them, to record information about past environmental change, and its influence on landscapes. Several recent modelling studies have begun to explore these relationships, with an emphasis on identifying the types of environmental signals that could be preserved in stratigraphic records. However, factors controlling alluvial catchment behaviour in response to environmental change have not been systematically analysed, and connections between stratigraphic and geomorphic archives remain underexplored.

We build on a new approach for modelling the long-profile evolution of alluvial rivers, described by Wickert and Schildgen (2019). Their non-linear diffusion model is derived from first principles, defined in terms of the physical properties of alluvial river networks, and, unlike previous models of its kind, includes important alluvial-channel dynamics such as their tendency to adjust their widths in response to changing sediment or water supply. We first focus on the simple case of an alluvial valley with constant properties, such as valley width and channel sinuosity, along stream. Using a method known as perturbation analysis, we derive approximate analytical expressions that describe how amplitudes of aggradtion-incision cycles and variations in sediment discharge, and the timescales over which these signals propagate downstream, depend on the rate of environmental change, and catchment geometry and hydrology. Using numerical models, we go on to explore how this behaviour is affected by downstream supply of water and sediment by tributaries. Our results have several important implications for interpretations of both stratigraphic and geomorphic archives. For example, we predict that, in certain circumstances, cycles of aggradation and incision may significantly lag behind environmental change, complicating comparisons of terrace ages and paleaoclimate records. Our approach provides a new quantitative framework for understanding stratigraphic and geomorphic records, and is a first step towards using these archives together to reconstruct past environmental change.

References

Wickert, A., Schildgen, T., 2019, Long-profile evolution of transport-limited gravel-bed rivers. Earth Surface Dynamics 7, 17—43, doi: 10.5194/esurf-7-17-2019.

Session 3 – Synchronisation and Dating of Proxy Records

Old sediments in new light - "unusual" light microscopic methods for the study of varved lake sediments

Mingram, Jens*

GFZ German Research Centre for Geosciences, Section Climate Dynamics and Landscape Evolution, Potsdam, Germany
* Corresponding author: jens.mingram@gfz-potsdam.de

Microscopic examination of finely laminated sedimentary structures is an essential part of the study of sediments. Seasonally resolved lake sediments offer unique opportunities to understand the dynamics of abrupt climate changes, especially for paleoclimate studies. Precise varve chronologies require a sedimentation model that is as accurate as possible and the visualization of annual layers over longer profiles.

Usually, sediment thin sections are examined in plane parallel or polarized transmitted light. For more precise microscopic characterization of minerogenic and organogenic sediment components, various separate analytical methods (e.g. µ-XRF, SEM, microprobe, IR and Raman microscopy) can now be used, but they are all analytically complex and expensive, and also usually require different sample preparation.

However, there are simple, well-known light microscopic methods that can be used with good and sometimes surprising results for the microscopic analysis of lake sediments. Here, the advantages of dark field microscopy, fluorescence microscopy and oblique illumination will be discussed in more detail and examples from different lakes will be presented.

With dark field illumination, fine particles “swimming” in a homogeneous matrix are usually illuminated from the side and under central shadowing. Only light reflected from the particles then reaches the microscope objective, while the non-reflecting matrix appears as a dark background. Sediment thin sections do not have a homogeneous matrix, but the different reflectivity of certain sediment particles can also cause a dark field effect (Fig. 1).

Fluorescence microscopy is ideal for visualizing pollen and spores, which often accumulate seasonally. These important components are usually very difficult to detect in the microscopic image because of their optical properties (optically isotropic and similar refraction to the embedding medium). When excited with short-wave light, however, they often show a characteristic fluorescence.

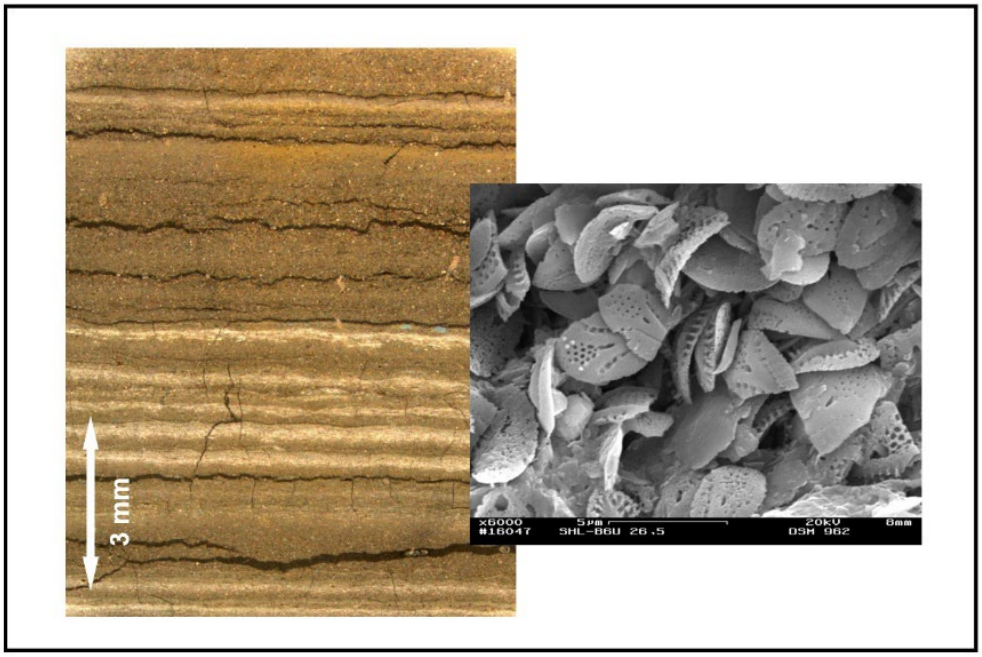

Fig. 1: *Clastic stadial sediments with enrichments of Chrysophyte cysts from Lake Sihailongwan (NE China). Left: dark field illumination. Right: SEM photo of one Chrysophyte layer.*

Session 1 – Climate variability and warmer climates

Paleoclimate reconstruction using middle to late Pleistocene alluvial paleosols of the middle Atbara River in Eastern Sudan

Mohammednoor, Mosab[1, 2, 3*]; Bussert, Robert[1]; Tsukamoto, Sumiko[4]; Bedri, Omer[5]; Kraatz, Brian[6]; Müller, Johannes[2]; Salih, Khalafallah[7]; Struck, Ulrich[2]; Eisawi, Ali[3,7] & Bibi, Faysal[2]

[1]Technische Universität Berlin, Institute of Applied Geosciences, Ernst-Reuter-Platz 1, 10587 Berlin, Germany
[2]Museum für Naturkunde, Invalidenstrasse 43, 10115 Berlin, Germany
[3]University of Khartoum, Department of Geology, Al-Gama'a Avenue, 11111 Khartoum, Sudan
[4]Leibniz Institute for Applied Geophysics, Stilleweg 2, 30655 Hannover, Germany
[5]International University of Africa, Faculty of Minerals and Oil, Madani St, Khartoum 12223, Sudan
[6]Western University of Health Sciences, Department of Anatomy, Pomona, CA 91711, USA
[7]Al Neelain University, Faculty of Petroleum and Minerals, El Gamhuriya Avenue, 11121 Khartoum, Sudan
*Corresponding author: Mosab.Alamin@mfn.berlin

Keywords: Middle Atbara, calcrete, paleosols, Aridisols, Vertisols, CIA, hominins

The Atbara River in eastern Sudan today has its headwaters in the northern Ethiopian Plateau and is the last major tributary of the Nile before it flows through the Sahara. Along its middle reach, Pleistocene alluvial sediments, dated to about 200 to 20 ka, are exposed for about 200 km with a maximum thickness of 50 m. The Pleistocene sediments are rich in stone tools as well as fossil land mammals, including hominins. Previous work identified two sedimentary units separated by a major unconformity, the Butana Bridge Synthem (BBS) and the Khashm El Girba Synthem (KGS), each subdivided into three intervals BBS 1-3 and KGS 1-3, from bottom to top. Paleosols characterized by pedogenic features such as calcretes, root structures and pedogenic slickensides are present in the alluvial sediments. We used the paleosols to reconstruct the paleoclimate in the study area by performing mineralogical, petrographic, geochemical and isotopic analyses.

Both the field studies and the laboratory results indicate that paleosols similar to modern-day Aridisols (desert soils) and Vertisols (swelling clay soils) are most common, which are soils typical of arid to semi-arid and seasonally moist to subhumid climates. The Aridisols are common in BBS, KGS 3 and partially in KGS 1 sedimentary units. They are characterized by calcretes, calcareous nodules and root structures and contain carbonate minerals, as well as sulfate and halide minerals. Clay minerals are dominantly mica, smectite, chlorite, and easily weatherable silicate minerals (e.g. feldspar) are also common. Vertisols are dominant in KGS 2 and exhibit blocky peds and pedogenic slickenside structures due to the shrinking and swelling of smectitic clays. Chemical index of alteration (CIA) values suggest that paleosols underwent moderately intense weathering during their formation. Minerals such as zeolite, hornblende and chlorite in both paleosol types point partially to mafic source rocks such as basalt, which are also widespread in the modern Atbara drainage basin. The $\delta^{13}C$ isotope values of pedogenic carbonates indicate that the vegetation varied between grassland, wooded grassland and woodland/bushland/thicket/shrubland during the formation of both the Aridisols and the Vertisols. The $\delta^{18}O$ values indicate an increased evaporation/precipitation ratio, which, like the paleosol types, suggests that the region had a predominantly semi-arid climate similar to present-day conditions during the middle to late Pleistocene. The paleosols intercalated in the BBS 2 and 3 and KGS 1 and 3 sedimentary units formed during MIS7, MIS6 and MIS2 indicate a relatively arid climate. In contrast, the KGS2 paleosols, formed during MIS5 and MIS4, reflect a seasonal sub-humid to semi-arid climate.

Session 3 – Synchronisation and Dating of Proxy Records

Small but mighty – Synchronization of sediment records in the Baltic realm using cryptotephra

Müller, Daniela[1*]; Neugebauer, Ina[1]; Kearney, Rebecca[1]; Schwab, Markus J.[1]; Appelt, Oona[2]; Czymzik, Markus[3]; Kaiser, Jérôme[3]; Arz, Helge W.[3] & Brauer, Achim[1,4]

[1] GFZ German Research Centre for Geosciences, Sect. 'Climate Dynamics and Landscape Evolution', Potsdam, Germany
[2] GFZ German Research Centre for Geosciences, Section ‘Chemistry and Physics of Earth Materials’, Potsdam, Germany
[3] Marine Geology, Leibniz Institute for Baltic Sea Research Warnemünde (IOW), Rostock, Germany
[4] University of Potsdam, Institute of Geosciences, Potsdam, Germany
* Corresponding author: daniela.mueller@gfz-potsdam.de

Robust and precise chronologies of paleoclimate records are a prerequisite for studies of climatic changes in the past. One valuable geochronological tool is the identification of volcanic ash (tephra) from past volcanic eruptions, since tephra deposits can be used as time-parallel markers that allow direct synchronization between different records (Davies et al., 2012; Lane et al., 2017; Lowe, 2011). Novel methodological developments even allow the identification of macroscopically invisible volcanic ash (so-called cryptotephra) that can be found in sedimentary records thousands of kilometres away from the volcanic source (e.g. Lane et al., 2014; Neugebauer et al., 2021; Wulf et al., 2016).

Here, we present new cryptotephra findings from Lake Tiefer See (NE Germany) and for the first time from the Baltic Sea. These two sedimentary records are investigated within the frame of the BALTRAP project (‘The Baltic Sea and its southern Lowlands: proxy – environment interactions in times of Rapid change’), aiming to improve the understanding of the impact of rapid climate change in the southern Baltic Sea region. For this purpose, unambiguous synchronization of the records and their proxy data is essential. Three cryptotephra horizons containing glass shards from Icelandic eruptions have been identified at both sites providing robust anchor points for the individual chronologies and their synchronization throughout the mid- to late Holocene (ca 4.3 ka BP until AD1875). The youngest tephra horizon at both sites is the Askja-AD1875 (see Wulf et al. (2016) for Lake Tiefer See) and glass shards from the other tephra horizons tentatively correlate with the Hekla-4, Hekla-3 and with the Grákolla-2 ka Askja (A~2000) eruptions. These cryptotephra findings further allow the synchronization of the Lake Tiefer See and Baltic Sea sediment records with other European sites and the investigation of possible leads and lags in proxy responses to abrupt climate changes.

References

Davies, S.M., Abbott, P.M., Pearce, N.J.G., Wastegård, S., Blockley, S.P.E., 2012. Integrating the INTIMATE records using tephrochronology: rising to the challenge. Quat. Sci. Rev. 36, 11–27. https://doi.org/10.1016/j.quascirev.2011.04.005

Lane, C.S., Cullen, V.L., White, D., Bramham-Law, C.W.F., Smith, V.C., 2014. Cryptotephra as a dating and correlation tool in archaeology. J. Archaeol. Sci. 42, 42–50.

Lane, C.S., Lowe, D.J., Blockley, S.P.E., Suzuki, T., Smith, V.C., 2017. Advancing tephrochronology as a global dating tool: Applications in volcanology, archaeology, and palaeoclimatic research. Quat. Geochronol. 40, 1–7. https://doi.org/10.1016/j.quageo.2017.04.003

Lowe, D.J., 2011. Tephrochronology and its application: A review. Quat. Geochronol. 6, 107–153. https://doi.org/10.1016/j.quageo.2010.08.003

Neugebauer, I., Müller, D., Schwab, M.J., Blockley, S., Lane, C.S., Wulf, S., Appelt, O., Brauer, A., 2021. Cryptotephras in the Lateglacial ICDP Dead Sea sediment record and their implications for chronology. Boreas 50, 844–861. https://doi.org/10.1111/bor.12516

Wulf, S., Dräger, N., Ott, F., Serb, J., Appelt, O., Gudmundsdóttir, E., van den Bogaard, C., Słowiński, M., Błaszkiewicz, M., Brauer, A., 2016. Holocene tephrostratigraphy of varved sediment records from Lakes Tiefer See (NE Germany) and Czechowskie (N Poland). Quat. Sci. Rev. 132, 1–14. https://doi.org/10.1016/j.quascirev.2015.11.007

Session 3 – Synchronisation and Dating of Proxy Records

A tree-ring reconstruction of streamflow variability over the last ~250 years in the Lower Danube

Nagavciuc, Viorica[1,2*]; Roibu, Catalin-Constantin.[1]; Mursa, Andrei[1]; Stirbu, Marian[1]; Popa, Ionel[134] & Ionita, Monica[1,2,5]

[1] Forest Biometrics Laboratory – Faculty of Forestry, ”Stefan cel Mare” University of Suceava, Universității street no. 13, Suceava, 720229, Romania;
[2] Alfred Wegener Institute for Polar and Marine Research, Bussestr. 24, Bremerhaven, 27570, Germany;
[3] National Research and Development Institute for Silviculture ”Marin Drăcea”, Calea Bucovinei 76bis, Câmpulung Moldovenesc, 725100, Romania;
[4] Center of Mountain Economy -INCE - CE-MONT Vatra Dornei, Petreni street no 49, Vatra Dornei, 725700, Romania
[5] Emil Racovita Institute of Speleology, Romanian Academy, Cluj-Napoca, 400006, Romania
* Corresponding author: nagavciuc.viorica@gmail.com

Paleoclimate reconstructions are increasingly used to characterize climate variability and change prior to the instrumental record, in order to improve our estimates of climate extremes and to provide a baseline for climate change projections. Most of these reconstructions are focused on temperature, precipitation, and/or drought indices, and to a lesser extent to reconstruct streamflow variability. In this study, a regional tree-ring width chronology (i.e. *Quercus petraea)*, from Caraorman forest (Danube Delta, Romania), was used to reconstruct the last ~250 years of annual (from November previous year to July current year) streamflow of the Lower Danube River. The obtained results indicate a stable and significant correlation between the measured tree-ring width from Caraorman forest and Danube streamflow at Ceatal Izmail hydrologic station situated in the south-eastern part of Europe. The statistical parameters of the reconstruction model confirm that our model is stable and robust, explaining 44.9 % of the variance of the Lower Danube streamflow over the period 1920 – 2013. Interannual streamflow variation for the analyzed period indicates 11 extremely high flow years, with streamflow greater than 9200 m^3/s (1170, 1771, 1799, 1836, 1838, 1839, 1871, 1876, 1877, 1940, and 2010) and 11 extremely low flow years, with streamflow lower than 5200 m^3/s (1750, 1753, 1753, 1773, 1794, 1832, 1843, 1882, 1921, 1964, and 1994). The influence of the large-scale atmospheric circulation on the TRW variability was analyzed using the composite maps of the geopotential height at 500 mb (Z500) and sea surface temperature (SST). High TRW values (e.g. high streamflow periods) from the Caraorman forest are associated with a low-pressure system centered over Europe and positive SST anomalies over the Atlantic Ocean and negative SST anomalies over the Baltic, North, and Mediterranean Seas. These large-scale conditions favor the advection of moist air from the Mediterranean and the Black Sea towards the south-eastern part of Romania, which in turn leads to high precipitation rates over this region. Opposite to this, low TRW values (e.g. low streamflow periods) are associated with a high-pressure system centered over Europe, a northward shift of the storm tracks and negative SST anomalies over the Atlantic Ocean, and positive SST anomalies over the Baltic, North, and Mediterranean Seas. Based on our results we argue that the reconstruction of river streamflow data based on the tree-ring width has important scientific and practical implications for a better understanding of the streamflow variation of the past, necessary for water resource management, and environmental-hydrological protection.

Session 5 – Earth Surface Processes and Environmental Change

Detailed investigation of the unconformity in the lower part of the loess profile Bahlingen-Schönenberg

Nuss, Margarita[1*]; Fülling, Alexander[1]; Sprafke, Tobias[2,3] & Preusser, Frank[1]

[1] Institute of Earth and Environmental Sciences, University of Freiburg, Germany
[2] Center of Competence for Soils, Bern University of Applied Sciences, Switzerland
[3] Institute of Geography, University of Bern, Switzerland
* Corresponding author: margarita.nuss@outlook.de

Loess/palaeosols sequences are used for the reconstruction of environmental conditions and serve as fundamental archives in Quaternary research. The landscape of the Kaiserstuhl in the Upper Rhine Graben is characterised by massive loess deposits that have not been systematically investigated since the 1980ies (Guenther 1987; Zöller et al. 1992). A recent study at Bahlingen-Schönenberg (Schulze et al. 2022) identified a major unconformity in the lower part of the LPS that according to luminescence dating is older than Marine Isotope Stage (MIS) 4, while the section above the hiatus formed by quasi-continuous loess sedimentation between ca. 34 and 27 ka, interrupted by phases of weak reductive pedogenesis. The unconformity is investigated in further detail in this study to gain a better understanding of the prevailing environmental conditions, and the associated sedimentological and climatic processes. For the present investigations, the profile was extended and sampled, and additional profiles along the exposure were created to the west and to the east of the central section. Grain size determination, colour measurement, determination of the organic and inorganic carbon content and infrared stimulated luminescence (IRSL) screening were used in combination with luminescence dating. IRSL screening reveals the hiatus in a markedly higher position in the profiles to the east and west of the initial profile Bahlingen-Schönenberg. The progression of the unconformity can be located throughout the entire loess wall. The upper 50 cm of the additional profiles are classified as MIS 2, followed by a transition from MIS 5 to MIS 6 in the lower part. The results of the recent study will be presented in detail and compared with other loess profiles.

References

Guenther, E. W. 1987. Zur Gliederung der Lösse des südlichen Oberrheintals. E&G Quaternary Science Journal, 37, 67–78.

Schulze, T., Schwahn, L., Fülling, A., Zeeden, C., Preusser, F., and Sprafke T. 2022. Investigating the loess-palaeosol sequence of Bahlingen-Schönenberg (Kaiserstuhl), SW-Germany, using a multi-methodological approach. E&G Quaternary Science Journal. (accepted after minor revisions)

Zöller, L., Stremme, H., and Wagner, G.A. 1988. Thermolumineszenz-Datierung an Löss-Paläoboden-Sequenzen von Nieder-, Mittel- und Oberrhein/Bundesrepublik Deutschland, Chemical Geology, 73, 39–62.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Human impact on cyanobacteria during the Holocene revealed by sedimentary DNA from Lake Tiefer See

Nwosu, Ebuka Canisius[1]; Brauer, Achim[2,3]; Monchamp, Marie-Eve[4]; Pinkerneil, Sylvia[2]; Bartholomäus, Alexander[1]; Theuerkauf, Martin[5]; Stoof-Leichsenring, Kathleen R.[6]; Wietelmann, Theresa[6]; Kaiser, Jerome [7] & **Liebner, Susanne[1,8*]**

[1]GFZ German Research Centre for Geosciences, Helmholtz Centre Potsdam, Section Geomicrobiology, 14473 Potsdam, Germany
[2]GFZ German Research Centre for Geosciences, Helmholtz Centre Potsdam, Section Climate Dynamics and Landscape Evolution, 14473 Potsdam, Germany
[3]Institute of Geosciences, University of Potsdam, 14476 Potsdam, Germany
[4]Department of Biology, McGill University, Montreal, QC H3A 0G4, Canada
[5]Institute of Botany and Landscape Ecology, University of Greifswald, D-17489 Greifswald, Germany
[6]Polar Terrestrial Environmental System, Alfred Wegener Institute Helmholtz Centre for Polar und Meeresforschung, 14473 Potsdam, Germany
[7]Marine Geology, Leibniz Institute for Baltic Sea Research, 18119 Rostock-Warnemünde, Germany
[8]Institute of Biochemistry and Biology, University of Potsdam, 14476 Potsdam, Germany
*corresponding author: sliebner@gfz-potsdam.de

Sedimentary DNA-based studies revealed effects of eutrophication on lake cyanobacterial communities mainly in the last two centuries, but we lack information over the entire Holocene. We used sedimentary ancient DNA of Lake Tiefer See in northeastern Germany to reconstruct cyanobacteria communities spanning the last 11,000 years using a set of molecular techniques including quantitative PCR, biomarkers, metabarcoding, and metagenome sequence analyses. We found a substantial increase in total cyanobacteria abundance coinciding with deforestation during the early Bronze Age around 4000 years ago, suggesting increased nutrient supply to the lake by local communities settling on the lakeshore. Moreover, the early Bronze Age marks the timing of a significant compositional shift in cyanobacteria compared to the communities reconstructed in the previous seven millennia characterized by little to no human presence. Following this major change, the only subsequent significant anthropogenic-induced shift in cyanobacterial communities occurred recently (~100 yrs ago) and relates to intensified agricultural fertilization in the watershed. Our work suggests that humans began to impact lake cyanobacterial communities much earlier than previously thought, even in areas of relatively low human impact throughout the Holocene.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Tracking environmental changes at lake Tiefer See/NE-Germany – from monitoring to the sedimentary record

Plessen, Birgit*; Pinkerneil, Sylvia; Brademann, Brian; Köppl, Matthias; Schwab, Markus J. & Brauer, Achim

GFZ German Research Centre for Geosciences, Sect. 'Climate Dynamics and Landscape Evolution', Potsdam, Germany
* Corrresponding author: birgit@gfz-potsdam.de

Lake Tiefer See (TSK) is with 62 m a deep lake formed in an N-S oriented subglacial channel system in the late Allerød and filled with organic-dominated sediments since the onset of the Holocene. Today, the lake is situated in an intense arable used landscape with a mesotrophic water body, a summer stratification and an autumnal transition from oxic to anoxic conditions resulting in the sedimentation of annual varved layers composed of diatoms, calcite and organic (Kienel et al., 2017; Roeser et al., 2021). The Holocene sedimentary record is composed of autochthonous lacustrine sediments with varved and nonvarved intervals which contain a lot of information about past environmental changes (Dräger et al., 2017). Understanding of proxy data from long sedimentary records and the deciphering of natural and human impact is essential for the reconstruction of past climate and environmental changes (Mills et al., 2017).

To evaluate sedimentation processes and controlling factors and to observe regional and local impacts of ongoing global change we installed a long-term lake sediment monitoring at Lake Tiefer See in 2012 within the TERENO (Terrestrial Environmental Observatories) initiative of the Helmholtz Association. Our monitoring setup includes a permanent weather station, lake water observation, sediment trapping, and regular sampling of short sediment cores from different parts of the lake basin. Here we present our stable isotope study on lake water, trap and core sediments including $\delta^{18}O$ of water and carbonates, $\delta^{13}C$ of carbonates and organic and $\delta^{15}N$ of water and sediments to understand the fractionation processes of natural and human induced environmental changes and the transfer of the isotopic signatures in to the sediments.

References

Dräger, N., M. Theuerkauf, K. Szeroczyńska, S. Wulf, R. Tjallingii, B. Plessen, U. Kienel, and A. Brauer, 2017, Varve microfacies and varve preservation record of climate change and human impact for the last 6000 years at Lake Tiefer See (NE Germany): The Holocene, v. 27, p. 450-464.

Kienel, U., G. Kirillin, B. Brademann, B. Plessen, R. Lampe, and A. Brauer, 2017, Effects of spring warming and mixing duration on diatom deposition in deep Tiefer See, NE Germany: Journal of Paleolimnology, v. 57, p. 37-49.

Mills, K., D. Schillereff, É. Saulnier-Talbot, P. Gell, N. J. Anderson, F. Arnaud, X. Dong, M. Jones, S. McGowan, J. Massaferro, H. Moorhouse, L. Perez, and D. B. Ryves, 2017, Deciphering long-term records of natural variability and human impact as recorded in lake sediments: a palaeolimnological puzzle: Wiley Interdisciplinary Reviews: Water, v. 4, p. e1195.

Roeser, P., N. Dräger, D. Brykała, F. Ott, S. Pinkerneil, P. Gierszewski, C. Lindemann, B. Plessen, B. Brademann, M. Kaszubski, M. Fojutowski, M. J. Schwab, M. Słowiński, M. Błaszkiewicz, and A. Brauer, 2021, Advances in understanding calcite varve formation: new insights from a dual lake monitoring approach in the southern Baltic lowlands: Boreas, v. 50, p. 419-440.

Session 5 – Earth Surface Processes and Environmental Change

Unravelling stratigraphic, glacio- and geodynamic information from glaciofluvial terrace hypsometry, North Alpine Foreland

Pollhammer, Thomas[1*]; Salcher, Bernhard[1]; Kober, Florian[2] & Deplazes, Gaudenz[2]

[1] University of Salzburg, Dept. of Environment and Biodiversity, Salzburg, Austria
[2] NAGRA Switzerland, Hardstrasse 73, 5430 Wettingen, Switzerland
* Corresponding author: thomaspollhammer@gmx.at

Glaciofluvial terraces of the North Alpine Foreland have been subject to Quaternary research for more than one hundred years. In fact, the terrace stratigraphic model of Penck and Brückner (1909) is pivotal still today. However, local findings by different geologic surveys lead to the necessity of local adaptions of the stratigraphic model, leading to major inconsistencies on the mountain range scale between states and federal states.

The resulting geometry of glaciofluvial outwash is significantly controlled, aside from stream discharge and sediment supply, by the horizontal distance and elevation difference between glacier terminus and receiving stream. Rapid glacier melting and associated terrace abandonment may provide distinct terrace surfaces, which can be preserved over glacial to interglacial timescales upon continuous surface uplift. While terrace slopes (straths and treads) can be indicative for the relative position of the glacier termini, modifications to the inital surface hypsometry can refer to the magnitude and wavelength of this uplift signal. Terraces can therefore not only provide significant stratigraphic information but may provide insights into (local) glacial dynamics and regional tectonic processes. Recent developments on the availability and resolution of digital elevation models offer the opportunity to analyse surfaces on a regional scale in high detail, therby providing a consistent data basis for statistical investigations. Based on a GIS compilation of existing data (digital elevation models, geologic maps, sedimentologic data), we use a self developed morphostratigraphic method, within the software R, to create 2D paleo-river-long-profiles to i) test the existing terrace stratigraphy, ii) point out evidence, that needs to be adressed by attempts of future stratigraphic harmonizations, iii) test possible terrace correlations in Switzerland and across the boundary of the major catchments of Rhine and Danube, and iv) with the help of existing age constraints, collect evidence based data on Quaternary uplift rates across the foreland.

References

Penck, A., & Brückner, E. (1909): Die Alpen im Eiszeitalter. Leipzig: Tauchnitz.

Session 1 – Climate variability and warmer climates

Paleohydrological evolution during the Late Glacial based on compound-specific δ^2H and $\delta^{18}O$ analyses from Lake Bichlersee (Bavarian Alps)

Prochnow, Maximilian[1*]; Bliedtner, Marcel[1]; Strobel, Paul[1]; Struck, Julian[1]; Bittner, Lucas[2]; Schneider, Heike[1]; Zech, Michael[2] & Zech, Roland[1]

[1] Friedrich Schiller University Jena, Institute of Geography, Jena, Germany
[2] Technical University Dresden, Institute of Geography, Dresden, Germany
* Corresponding author: maximilian.prochnow@uni-jena.de

The European Alps experienced major climatic and environmental changes during the Bølling-Allerød complex (14,700 – 12,800 cal. BP) and the Younger Dryas (12,800 – 11,700 cal. BP). $\delta^{18}O$ records from lake sediments and speleothems have been interpreted to reflect temperature because they show a similar pattern compared to Greenland. However, disentangling various effects on single isotopes is very difficult. Past changes in evaporative enrichment could have played an important role, but have not been considered yet. Here we present results from compound-specific δ^2H and $\delta^{18}O$ analyses on *n*-alkanes and hemicellulose sugars, respectively, from a 15.6 ka sediment core from Bichlersee (Bavarian Alps, South Germany). $\delta^2H_{n\text{-}C31}$ shows a distinct depletion during the Younger Dryas compared to the Bølling-Allerød and Early Holocene. This signal reflects the isotopic composition of leaf waxes, i. e. primarily the isotopic compostion of precipitation although somewhat modulated by evapo(transpi)rative enrichment. $\delta^2H_{n\text{-}C27}$ follows the same pattern but shows a stronger enrichment during the Bølling-Allerød and Early Holocene compared to $\delta^2H_{n\text{-}C31}$. *n*-C_{27} is a mixed component of aquatic and terrestrial sources (i.e., *Betula* trees) and thus its isotopic composition reflects the influence of terrestrial transpirative leaf water enrichment and aquatic evaporative lake water enrichment. $\delta^{18}O_{sugar}$ shows more depleted values during the Younger Dryas, whereas a strong enrichment occurs during the Early Holocene. The hemicellulose sugars fucose and xylose are mostly of aquatic origin and likely reflect the isotopic signal of the lake’s water, which is modulated by evaporative enrichment. $\delta^{18}O$ is therefore very sensitive to evaporative enrichment and thus documents changes in climatic conditions (i.e., relative humidity). Furthermore, our reconstruction of lake water *d*-excess yields a much greater amplitude compared to leaf water *d*-excess. With this in mind, we recommend considering the effect of lake water enrichment in addition to classical temperature and source-effects when interpreting stable isotope records from lacustrine sediments under temperate humid climate conditions.

Session 3 – Synchronisation and Dating of Proxy Records

Optical dating of Franconian loess, southern Germany: A comparison of polymineral and K-feldspar post-IR IRSL signals

Rahimzadeh, Neda[1*]; Sprafke, Tobias[2]; Thiel, Christine[3]; Terhorst, Birgit[4] & Frechen, Manfred[1]

[1] Leibniz Institute for Applied Geophysics, S3 Geochronology, Hannover, Germany
[2] University of Bern, Institute of Geography, Bern, Switzerland
[3] Federal Institute for Geosciences and Natural Resources, Federal Seismological Survey, Hannover, Germany
[4] Julius-Maximilians University of Würzburg, Institute of Geography and Geology, Würzburg, Germany
* Corresponding author: Neda.Rahimzadeh@leibniz-liag.de

Despite its wide distribution and well-differentiated profiles, loess in Franconia remains poorly studied. Following the studies by Skowronek (1982), loess in Franconia did not see detailed studies since the detailed work of Rösner (1990). In order to test the validity of pedostratigraphy and thus preliminary chronostratigraphic assumptions, absolute geochronological methods are crucial. In this study, we provide the stratigraphy of the well-resolved, presumably Late Pleistocene profiles of Kitzingen and Holzkirchhausen, based on Optically Stimulated Luminescence (OSL) dating. In order to establish a reliable luminescence chronology, we applied different luminescence dating approaches, including quartz OSL, polymineral fine grains (FG) and K-feldspar coarse grains (CG) post-infrared (IR) IRSL (pIRIR) signals.

Based on the age calculation for both FG polymineral and CG k-feldspar, all calculated ages are in stratigraphic order, ranging from Holocene to late Pleistocene, and in general confirm the former stratigraphical interpretations. A good agreement of the obtained ages is observed between both feldspar grain size fractions; they also agree well with the quartz OSL ages up to ~50 ka. Although the obtained ages from both grain size fractions are consistent, the different growth pattern of the dose response curves and correspondingly different saturation characteristics of fine and coarse grains are observed. Even though in our samples the discrepancy in ages is not very significant, we suggest the use of coarse-grained K-feldspar whenever possible in order to not be confronted with unknowns such as mineral composition of the polymineral fraction.

References

Lehmkuhl, F., Zens, J., Krauß, L., Schulte, P., Kels, H., 2016. Loess-paleosol sequences at the northern European loess belt in Germany: distribution, geomorphology and stratigraphy. Quaternary Science Review 153, 11-30.

Rahimzadeh, N., Sprafke, T., Thiel, C., Terhorst, B., Frechen, M., 2021. A comparison of polymineral and K-feldspar post-IR IRSL ages of loess from Franconia, southern Germany. E&G Quaternary Science Journal 70, 53-71.

Rösner, U., 1990. Die Mainfränkische Lößprovinz. Sedimentologische, pedologische und morphodynamische Prozesse der Lößbildung während des Pleistozäns in Mainfranken. Mitteilungen der Fränkischen Geographischen Gesellschaft, 290 pp.

Skowronek, A., 1982. Paläoböden und Lösse in Mainfranken vor ihrem landschaftsgeschichtlichen Hintergrund, Würzburger Geographische Arbeiten, Würzburg, pp. 89-107.

Zens, J., Schulte, P., Klasen, N., Krauß, L., Pirson, S., Burow, C., Brill, D., Eckmeier, E., Kels, H., Zeeden, C., Spagna, P., Lehmkuhl, F., 2018. OSL chronologies of paleoenvironmental dynamics recorded by loess-paleosol sequences from Europe: case studies from the Rhine-Meuse area and the Neckar Basin. Palaeogeography, Palaeoclimatology, Palaeoecology 509, 105–125.

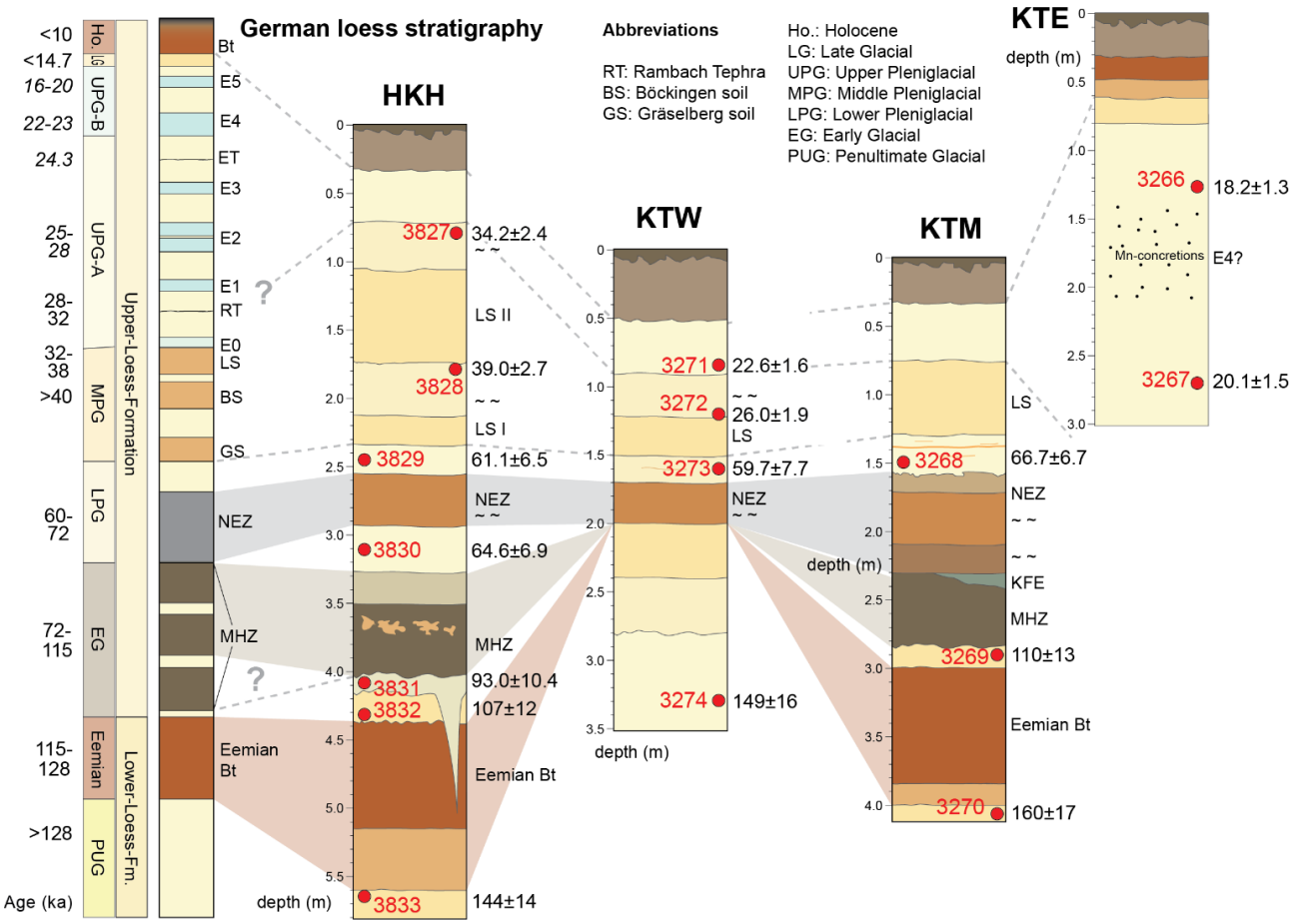

Fig. 1: *simplified stratigraphies of the investigated profiles with a summary of K-feldspar pIRIR225 ages and their correlation to German loess stratigraphy and approximate ages (from Lehmkuhl et al.(2016) with partly updated ages by Zens et al. (2018) in italics) (Rahimzadeh et al., 2021).*

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Between land reclamation and storm surges – man-environment interactions in the Trendermarsch (North Frisia, Germany)

Reiß, Antonia[1*]; Hadler, Hanna[1]; Wilken, Dennis[2]; Blankenfeldt, Ruth[3]; von Carnap-Bornheim, Claus[3]; Ickerodt, Ulf[4]; Klooß, Stefanie[4]; Majchczack, Bente[2]; Rabbel, Wolfgang[2]; Willershäuser, Timo[1].& Vött, Andreas[1]

[1] Johannes Gutenberg-Universität Mainz, Institute of Geography, 55099, Mainz, Germany
[2] Christian-Albrechts-Universität zu Kiel, Institute of Geosciences, 24118, Kiel, Germany
[3] Zentrum für baltische und skandinavische Archäologie, 24837 Schleswig, Germany
[4] Archäologisches Landesamt Schleswig-Holstein, 24837 Schleswig, Germany
* Corresponding author: areiss@uni-mainz.de

In the very north of Germany, the coastal landscape of North Frisia (Schleswig-Holstein, Germany) shows a changeful geomorphological past. What is nowadays part of the UNESCO world heritage “Wadden Sea” was an extensive cultural landscape in high medieval times. Intense man-environment interactions and major storm surges caused a rapid and permanent destruction of wide parts of this once densely settled region.

The so-called Trendermarsch on Nordstrand peninsula comprises both, high medieval marshland and its drowned counterpart. Landward of the modern dike, today’s topography still reflects the palaeogeography of the 13th to 14th cent. AD, including drainage ditches or dwelling mounds (terps). Seaward, however, lie the drowned remains of the former polder buried in the present-day tidal flats.

Our main objectives were to reconstruct the palaeogeography of the drowned Trendermarsch polder and to identify natural processes and human interventions in order to gain a better understanding of the medieval coastal landscape, its complex development and final destruction.

Geophysical prospection combined with vibracoring provide insights to the tidal flat’s subsurface and allow together with sedimentary, geochemical and microfaunal palaeoenvironmental parameters (PEP) for a detailed geoarchaeological analysis of the study area. The geochronological framework is based on radiocarbon dating, archaeological age estimations of ceramic fragments and historical reports.

Our results finally provide new insights into medieval settlement activities as well as land reclamation and cultivation measures that increased the coastal vulnerability against storm surges. Compared to the adjacent marshes, the Trendermarsch most likely served as an early settled site from which the surrounding areas were subsequently cultivated.

References

Busch, A. 1960. Eine alte Landoberfläche und Kulturspuren im Nordstrander Watt. Die Küste - Archiv für Forschung und Technik an der Nord- und Ostsee 8, 124–130.

Hadler, H., Vött, A., Newig, J., Emde, K., Finkler, C., Fischer, P., Willershäuser, T., 2018. Geoarchaeological evidence of marshland destruction in the area of Rungholt, present-day Wadden Sea around Hallig Südfall (North Frisia, Germany), by the Grote Mandrenke in 1362 AD. Quaternary International 473, 37–54.

Hadler, H., Vött, A., Willershäuser, T., Wilken, D., Blankenfeldt, R., Carnap-Bornheim, C., Emde, K., Fischer, P., Ickerodt, U., Klooß, S., Majchczack, B., Obrocki, L., Rabbel, W., 2021. Automated facies identification by Direct Push-based sensing methods (CPT, HPT) and multivariate linear discriminant analysis to decipher geomorphological changes and storm surge impact on a medieval coastal landscape. Earth Surface Processes and Landforms 46 (15), 1–24.

Session 1 – Climate variability and warmer climates

Geochemical proxies and radiocarbon data from a loess record of the Upper Palaeolithic site Kammern-Grubgraben, Lower Austria

Reiss, Lilian[1*]; Stüwe, Christian[1]; Einwögerer, Thomas[2]; Händel, Marc[2]; Maier, Andreas[3]; Meng, Stefan[4]; Pasda, Kerstin[5]; Simon, Ulrich[6]; Zolitschka, Bernd[7] & Mayr, Christoph[1, 8, 9]

[1] Friedrich-Alexander-Univeristät Erlangen-Nürnberg, Institute of Geography, Wetterkreuz 15, 91058 Erlangen, Germany
[2] Austrian Academy of Sciences, Austrian Archaeological Institute, Hollandstrasse 11-13, 1020 Vienna, Austria
[3] University of Cologne, Institute for Prehistoric Archaeology, Bernhard-Feilchenfeld-Strasse 11, 50969 Cologne, Germany
[4] University of Greifswald, Institute of Geography and Geology, Friedrich-Ludwig-Jahnstraße 16/17a, 17489 Greifswald, Germany
[5] Friedrich-Alexander-Universität Erlangen-Nürnberg, Institute of Prehistoric Archaeology, Kochstrasse 4/18, 91054 Erlangen, Germany
[6] 24837 Schleswig, Germany
[7] University of Bremen, Institute of Geography, Celsiusstrasse 2, 28359 Bremen, Germany
[8] Ludwig-Maximilians-Universität München, Department Earth and Environmental Sciences & GeoBio-Center, Richard-Wagner-Strasse 10, 80333, Munich, Germany
[9] Ludwig-Maximilians-Universität München, GeoBio-Center, Richard-Wagner-Strasse 10, 80333, Munich, Germany
[*] Corresponding author: lilian.reiss@fau.de

We analysed two loess sections from the Upper Palaeolithic site of Kammern-Grubgraben (Lower Austria) to evaluate geochemical proxies for their reliability and consistency in an archaeological context. The site is famous for its archaeological record containing abundant artefacts and faunal remains well-dated to between Greenland Stadials (GS) 3 and 2.1 (23.3 - 21.9 ka cal BP, Händel et al. 2021). Outside the archaeological context age determination is based on luminescence dating. For a better understanding of the environmental setting of the Palaeolithic hunter-gatherer occupations, we radiocarbon-dated different materials from various stratigraphic positions in the excavation profiles. Single charcoal fragments from a tundra gley located underneath the archaeological layers provided a reliable age of 28.9 - 27.8 ka cal BP (Fig. 1) that could relate to Greenland Interstadial 3 or 4. Furthermore, we analysed grain size, organic and inorganic geochemistry, as well as stable isotopes of the fine organic fraction ($\delta^{13}C_{org}$) and of rhizoconcretions ($\delta^{13}C$, $\delta^{18}O$) for palaeoenvironmental reconstructions. However, the radiocarbon-dated secondary pedogenic carbonate concretions provide a Holocene age and are, thus, not suitable for assessing climate and environmental changes during the time of loess deposition. $\delta^{13}C_{org}$ values indicate a predominance of C_3 vegetation. Sedimentological analyses suggest a humidity-related variability pointing at more humid and warmer conditions during the formation of the earlier part of the sediment sequence to drier and colder conditions towards the Last Glacial Maximum. X-ray fluorescence scans provide high-resolution elemental variations transformed to centred log-ratios. Increasing Ca values are in accordance with the independently analysed $CaCO_3$ record of the fine sediment fraction and also indicate drier conditions for the time after the formation of archaeological horizon 2. Decreasing Fe and Ti values are negatively correlated with Ca values, also indicating drier environmental conditions towards the top of the record.

References

Händel, M., Simon, U., Maier, A., Brandl, M., Groza-Săcaciu, S. M., Timar-Gabor, A., and Einwögerer, T.: Kammern-Grubgraben revisited – First results from renewed investigations at a wellknown LGM site in east Austria, Quatern. Int., 587–588, 137–157, https://doi.org/10.1016/j.quaint.2020.06.012, 2021.

Reiss, L., Stüwe, C., Einwögerer, T., Händel, M., Maier, A., Meng, S., Pasda, K., Simon, U., Zolitschka, B., and Mayr, C.: Evaluation of geochemical proxies and radiocarbon data from a loess record of the Upper Palaeolithic site Kammern-Grubgraben, Lower Austria, E&G Quaternary Sci. J., 71, 23–43, https://doi.org/10.5194/egqsj-71-23-2022, 2022.

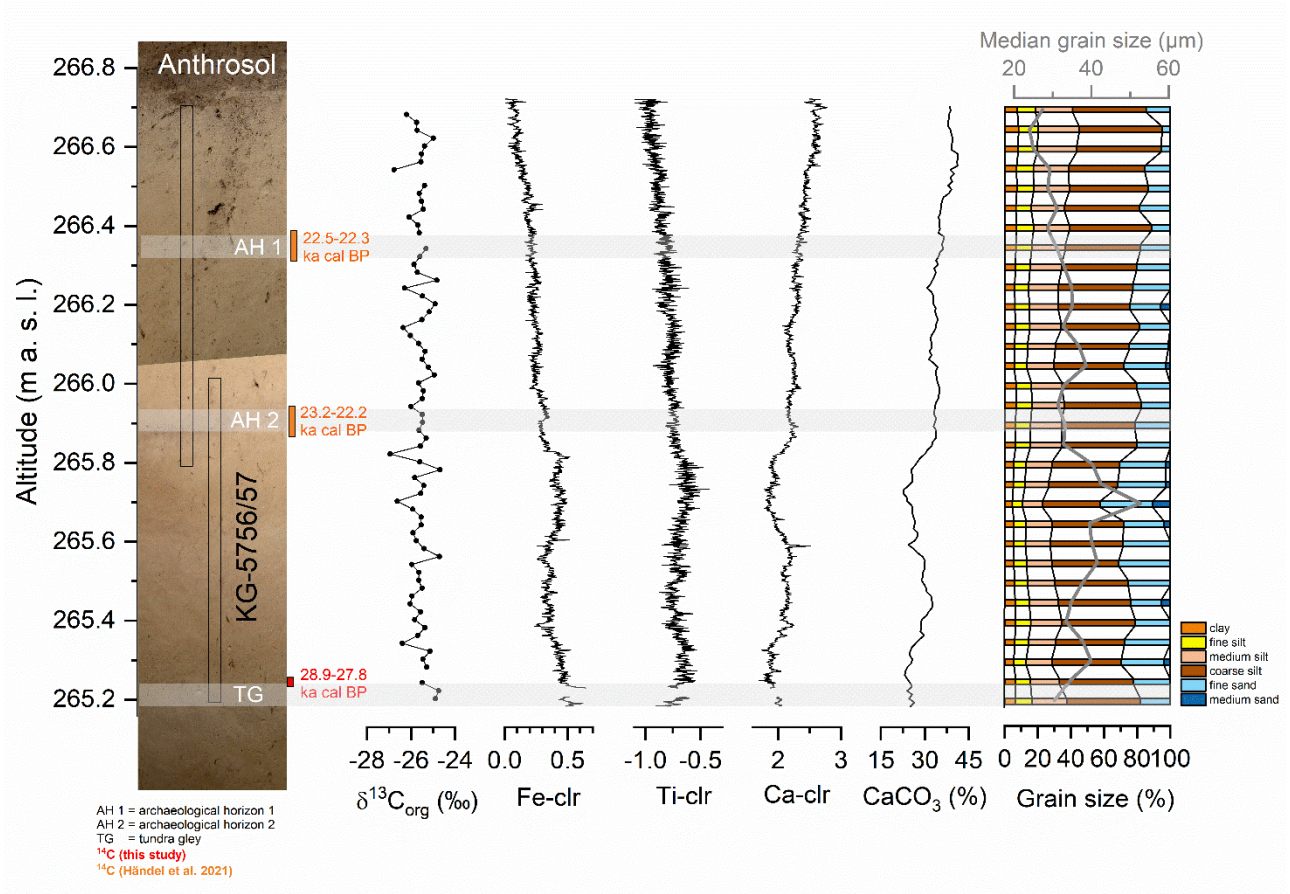

Fig. 1: *Organic carbon isotope ratio, elemental composition represented by centred log-ratios of iron, titanium and calcium (Fe-clr, Ti-clr, Ca-clr) and $CaCo_3$ contents, median grain size (gray line), and grain-size distribution of the analysed loess section (KG-5756/57) (Reiss et al. 2022). Grain sizes are classified according to standard size classes from medium sand to clay. For element contents derived from XRF-scanning analyses, centred log-ratio (clr)-transformation was applied to account for matrix effects. Shaded areas represent the archaeological horizons (AH 1 and AH 2) and the tundra gley (TG). Missing values are indicated by gaps.*

Session 5 – Earth Surface Processes and Environmental Change

The early Holocene Buchwiese rock avalanche (Eastern Alps, Austria): geological conditions, kinematics, morphological and sedimentary legacy

Reitner, Jürgen M.[1*]; Ivy-Ochs, Susan[2]; Steinemann, Olivia[2,3]; Lattner, Daniela[4] & Römer, Alexander[1]

[1] Geological Survey of Austria, Vienna, Austria.
[2] ETH Zurich, Laboratory of Ion Beam Physics, Zurich, Switzerland
[3] Gysi Leoni Mader AG, Zurich, Switzerland
[4] Vienna, Austria (former member of the Geological Survey of Austria)
* Corresponding author: juergen.reitner@geologie.ac.at

In this study we reconstructed the Buchwiese rock avalanche in the Lienz Dolomites in Eastern Tyrol (Austria) (Reitner et al. 2020). We used a multi-method approach combining geological field mapping, the analysis of digital elevation model (DEM) data, cosmogenic ^{36}Cl exposure dating, and a geoelectrical survey to unravel the detachment mechanisms, emplacement processes and timing of the Buchwiese rock avalanche. According to the results of the ^{36}Cl exposure dating, the event took place at 10.8±0.9 ka during the Early Holocene. The failure of a rock mass with a volume of $27x10^6$ m^3 was enabled by a dip-slope in strata of the Kössen Formation (limestone, marls, claystone), Oberrhätkalk (massive to thickly bedded limestone), Allgäu Formation (mottled limestone and marl) and Rotkalk (red nodular limestone and marl), in combination with N-S to NNE-SSW trending brittle faults. We regard fatigue of the fine-grained rocks of the Kössen Fm. (claystone, marl), typical slaking rocks, since the Last Glacial Maximum (LGM) as the major cause for this catastrophic rock slope failure. With the reconstructed drop height (H) of 1200 m and runout length (L) of 3.5 km, the Buchwiese rock avalanche has a Fahrböschung angle α of 19° and H/L ratio of 0.36. Due to the geological conditions, the initial failure occurred as a plane slide. In the deposition area, we observe strong control of lithological properties, topographic conditions, and substrate materials along the pathway on the morphology and sedimentology of the rock avalanche deposit. Longitudinal ridges, indicating spreading of an unconfined flow, are comprised mostly of massive limestone (Oberrhätkalk). The carapace facies consisting of clast-supported boulders is only developed in areas with limestone (mostly Oberrhätkalk but also limestone of the Kössen Fm.). The body facies in the upper parts are dominated by jigsaw subfacies with a subordinate occurrence of fragmented subfacies in the outcrops. Even in the middle part of the deposition area, we observe the prevalence of the moderately fragmented jigsaw subfacies within large areas of Kössen Fm. debris, which consists of alternating claystone, limestone beds.

Such a finding may indicate preferential deformation within the claystone beds. After partial collision with a bedrock ridge and a small jump, the fragmented subfacies dominates. This collision led to the formation of a fan-like megaboulder cluster consisting of detached and fragmented Oberrhätkalk boulders with volumes up to 1000 m^3 and a fan-like distribution. The results of geoelectrical surveys reflect different amounts of fragmentation with the carapace facies, showing high resistivity, while the body facies reveals low resistivity. Preserved source stratigraphy within the dilated rock mass indicates predominantly laminar rock avalanche movement. All the morphological and sedimentary evidence supports a dynamic fragmentation model as the best mechanical explanation for the Buchwiese rock avalanche.

References

Reitner, J. M., Ivy-Ochs, S., Steinemann, O., Lattner, D., & Römer, A., 2020. The early Holocene Buchwiese rock avalanche (Eastern Alps, Austria): geological conditions, kinematics, morphological and sedimentary legacy. Alpine and Mediterranean Quaternary, 33(2), 165-181.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Begriffskataloge der Geologischen Landesaufnahme für Quartär und Massenbewegungen in Österreich: Grundlage und Praxis

Reitner, Jürgen M.[1*]; Steinbichler, Mathias[1]; Lotter, Michael[1] & Steinbichler, Andrea[1]

[1] Geologische Bundesanstalt / Geological Survey of Austria, Vienna, Austria.
* Kontakt: juergen.reitner@geologie.ac.at

Die „gleiche Terminologie“ im Sinne von gleich verstandenen und ebenso verwendeten Begriffen ist in den Geowissenschaften von essenzieller Bedeutung für die Erhebung, Auswertung und Darstellung von Geodaten. Die Geologische Bundesanstalt (GBA), als zentrale Einrichtung für Wissensmanagement in den Geowissenschaften in Österreich, betrachtet es als wesentliche Aufgabe, die dafür benötigten Standards zu definieren. Aufbauend auf der Generallegende für die pleistozänen und holozänen Sedimente des Periglazialraumes (Krenmayr et al., 2012) und auf den bisher in den GBA-Karten verwendeten Begriffe wurde eine Nomenklatur für Einheiten und Ablagerungsformen des Quartärs entwickelt (Steinbichler et. al. 2019). Diese werden in kartierbare Sedimentkörper (Lithogenetische Einheiten) und Reliefformen (Geomorphologische Einheiten) sowie zusätzliche für die Kartendarstellung relevante Informationen (Quartäre Phänomene) unter grundsätzlicher Berücksichtigung der etablierten prozessorientierten Klassifikation eingeteilt. Die Begriffe sind entsprechend thematisch zusammengefasst und folgen einer einfachen hierarchischen Ordnung. Durch die Hierarchisierung können die Begriffe in Aufnahmemaßstäben (1:10.000) bis hin zu Darstellungsmaßstäben (1:25.000, 1:50.000, 1:200.000) sowie auch in der Punktdatenaufnahme verwendet werden.

Mit den Begriffskatalogen liegt eine Beschreibung für die strukturierte Datenerfassung und Kartierung im Gelände sowie für die Erstellung eines digitalen Datensatzes (inklusive Karten) vor. Damit ist eine zitierbare Grundlage für die geologische Landesaufnahme in den Themenbereichen Quartär und Geomorphologie gegeben. Das publizierte Werk spiegelt den derzeitigen Wissenstand wider und ist dementsprechend nach einer fachredaktionellen Prüfung modifizier- und erweiterbar. So erfolgte auch schon eine erste notwendige Ergänzung im Bereich der Massenbewegungen (Lotter et al., 2021).

Literatur

Krenmayr, H.-G., Ćorić, S., Gebhardt, H., Iglseder, C., Linner, M., Mandl, G., Reitner, J., Rockenschaub, M., Roetzel, R. & Rupp, C., 2012. Generallegende der pleistozänen bis holozänen Sedimente und Verwitterungsprodukte des Periglazialraumes auf den geologischen Spezialkarten (1:50.000, 1:25.000) der Geologischen Bundesanstalt. Jahrbuch der Geologischen Bundesanstalt 152, 57–66.

Lotter, M., Steinbichler, M., & Reitner, J.M. Ergänzung und Erratum zu „Begriffskataloge der Geologischen Landesaufnahme für Quartär und Massenbewegungen in Österreich“ (Steinbichler et al., 2019). Jahrbuch der Geologischen Bundesanstalt, 161, 157-160.

Steinbichler, M., Reitner, J.M., Lotter, M., Steinbichler, A., 2019. Begriffskataloge der Geologischen Landesaufnahme für Quartär und Massenbewegungen in Österreich. Jahrbuch der Geologischen Bundesanstalt 159, 5-49.

Session 1 – Climate variability and warmer climates

What Quaternary gastropods tell us about the effect of climate changes on Canary ecosystems

Richter, Christiane[1*]; Roettig, Christopher-Bastian[1]; Wolf, Daniel[1]; Groh, Klaus[2]; Kolb, Thomas[3] & Faust, Dominik[1]

[1]Department of Physical Geography, Dresden University of Technology, Dresden, Germany
[2]Consultant Office Klaus Groh, Hackenheim, Germany
[3]Department of Geomorphology, University of Bayreuth, Bayreuth, Germany
*Corresponding author: Christiane_richter@tu-dresden.de

Quaternary gastropod faunas on Fuerteventura have been studied in order to derive information about the temporal resolution and genesis of dune sequences on the Eastern Canary Islands as well as to gain information about palaeoclimatic and palaeoenvironmental conditions related to glacial-interglacial cycles for the study region. Our results show significant shifts in species compositions across the past 400 thousand years. We have identified certain species whose occurrence on Fuerteventura was limited to specific periods in time and which can therefore serve as fossil guide species in the sense of biostratigraphic markers. Very close ecological demands of these different species communities across time suggest that the above-described faunal shifts were caused by short-term stress events rather than long-term changes in local climatic conditions.

In order to gain additional information on the driving factors for the above-described faunal shifts, we carried out stable isotope analyses on shells of the genus *Theba*. There is evidence, that stable oxygen isotope signals of terrestrial snail shells at arid oceanic islands indirectly reflect the oxygen isotopy of the seawater. If we follow this approach, a first trend emerges that faunal shifts may be related to sea level rise (transitions from glacial to interglacial periods), which in turn may have been associated with indirect environmental changes (e.g., increased hot winds). As oxygen isotopy in terrestrial gastropod shells offers a high potential for palaeoclimatic reconstruction and the chronological correlation between terrestrial and marine archives, there is an urgent need for further studies especially on the shell isotopy of *Theba* and quantitative relationships between its influencing factors to evaluate the robustness of these first results.

Furthermore, we found that stable carbon isotope compositions of the *Theba* shells indicate a higher moisture related to reddish dust layers as well as to volcanic ash layers within the sequence. Both were continuously accompanied by increases in gastropod biodiversity, but not with fundamental changes in the basic species compositions and malacozonation. As local volcanic eruptions are generally not linked to climatic changes or sea level shifts, we assume that these humidity increases are substrate-related and occur independent from local climate conditions. As a consequence, we assume that the preservation of the uppermost reddish dust layer on the modern surface of Fuerteventura could significantly prevent the extinction of moisture requiring species such as gastropods on the island.

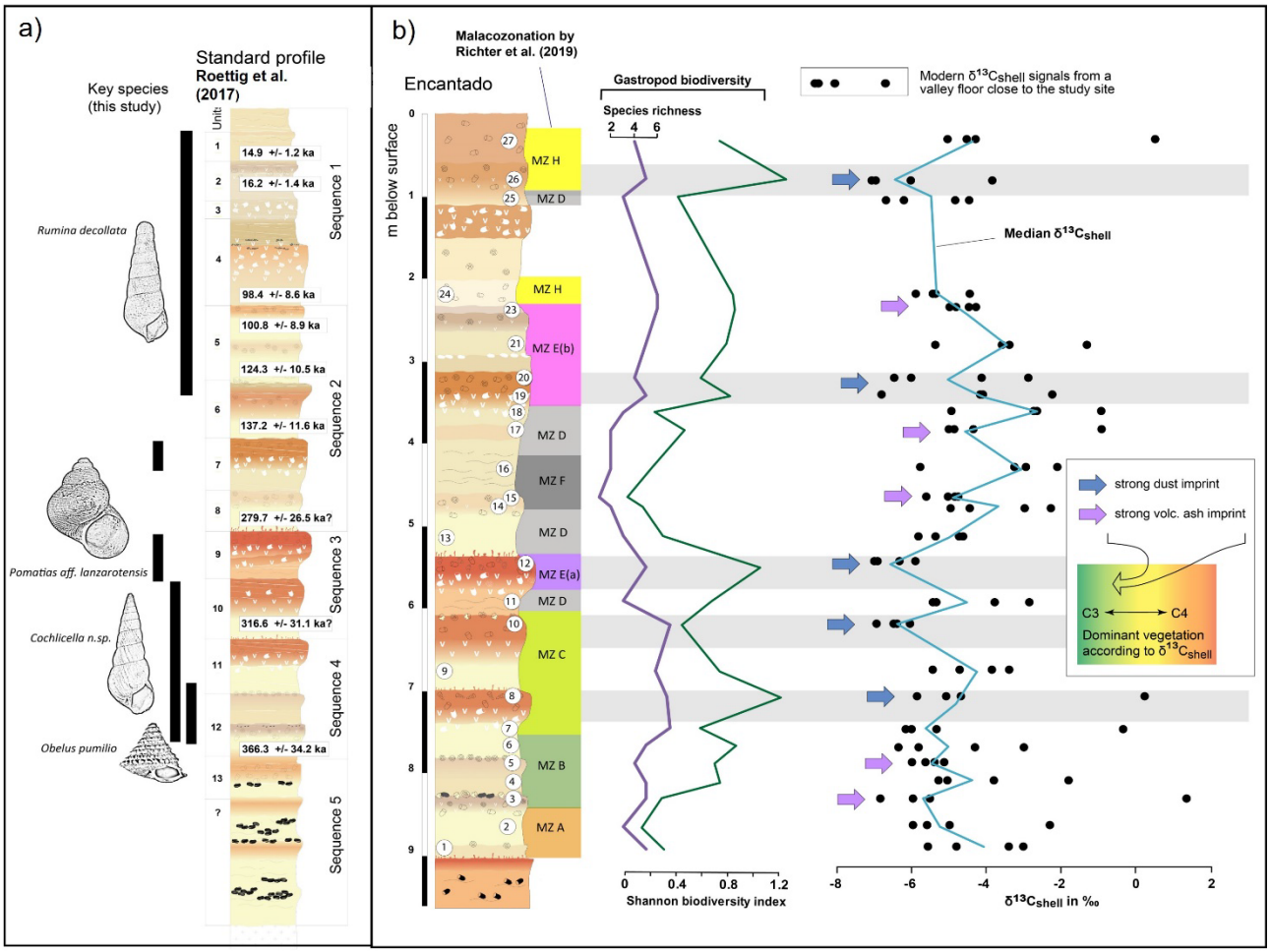

Fig. 1: (*a) Distribution of the four fossil guide species Rumina decollata, Pomatias aff. lanzarotensis, Cochlicella n. sp. and Obelus pumilio across the standard stratigraphic profile of dune sequences at Northern Fuerteventura; (b) Stratigraphic profile of the dune sequence “Encantado” (Northern Fuerteventura) shown with a scatter plot of $\delta^{13}C$ signals from fossil gastropod shells as well as modern shells (collected at a comparatively moist valley floor close by) and gastropod biodiversity proxies (species richness (purple) and Shannon index (green)). Reddish dust layers as well as volcanic ash layers relate to a higher gastropod biodiversity as well as more negative median values of the $\delta^{13}C$ shell signals (representing a higher proportion of the more moisture requiring C3-plants) and point to moisture peaks across the sequence being substrate-driven rather than climate-driven.*

Session 5 – Earth Surface Processes and Environmental Change

Modelling sediment dynamics in a mesoscale catchment of the Northern Franconian Jura, Germany

Ringleb, Bastian[1*] & Fuchs, Markus[1]

[1] Justus-Liebig-University Giessen, Department of Geography, Giessen, Germany
* Corresponding author: bastian.ringleb@geogr.uni-giessen.de

Since the beginning of the Neolithic era (circa 5500 BCE), human impact steadily became the driving factor behind soil erosion and natural landscapes were turned into cultural landscapes. Agriculture, livestock farming, and the clearing of large areas of forest changed the landscape permanently. An ever-changing natural balance challenged its inhabitants, resulting in a complex human-environment relationship represented by the modern-day landscape.

The Weismain river basin (circa 125 km2) located in the Northern Franconian Jura bears witness to this cultural landscape with its colluvial and alluvial sediment archives. Several high-resolution archives reveal a dense settlement history. However, the onset of sedimentation differs greatly between the upper part of the catchment (Bronze Age 2100 – 1550 BCE) and the floodplain deposits (circa 600 CE) in the lower parts.

We are now using a numerical modelling approach to get a better understanding of the sediment dynamics and the evolution of this catchment. However, its evolution is also closely related to its underlying bedrock. The Weismain river and its tributaries are deeply incised into a limestone plateau forming small, well-defined valleys that are opening up to wider floodplains in the lower parts of the catchment, where sandstone predominates. This karstic environment poses a particular challenge for our modelling efforts, where only a set of uniform parameters is used to describe this heterogeneous landscape. However, the prerequisites of this landscape are also a good opportunity to identify and quantify the impact of external and internal factors on the evolution of the Weismain river basin.

Session 5 – Earth Surface Processes and Environmental Change

Terrace formation in response to climate, regional uplift and local normal faulting recorded in the Danube terrace staircase of Vienna

Salcher, Bernhard[1,*]; Neuhuber, Stephanie[2]; Otto, Jan-Christoph[1]; Payer, Tom[3]; Lüthgens, Christopher[2]; Grupe Sabine[3]; Flores-Orozco, Adrian[4]; Nørgaard, Jesper[5]; Knudsen, Mads Faurschou[5] & Fiebig, Markus[2]

[1] University of Salzburg, Department of Environment and Biodiversity, Salzburg, Austria
[2] University of Natural Ressources and Life Sciences, Institute of Applied Geology (IAG), Vienna, Austria
[3] Geological Engineering Company, Wiener Gewässer Management GmbH, Vienna, Austria
[4] TU Wien, Department of Geodesy and Geoinformation, Vienna, Austria
[5] Aarhus University, Department of Geoscience, Aarhus, Denmark
* Corresponding author: bernhard.salcher@plus.ac.at

Quaternary landscape evolution in the Vienna Basin is significantly controlled by three major factors: the climate related behavior of the Danube River, local normal faulting, and regional uplift. Distinct trends of river aggradation and incision are a consequence of climatic oscillations related to the glacial - interglacial climate cyclicity. In the Vienna basin highest vertical slip/subsidence rates focus along narrow Middle-Pleistocene sub-basins impeding terrace formation. Outside the major Miocene Vienna Basin sidewall faults, normal faulting activity appears to be low or not existing during the Quaternary. In case regional uplift compensates local subsidence, complex “out of sequence” terrace levels can be the consequence. Complexity increases if rates change over time (i.e. tectonic activity vs. quiescence).

Local normal faulting superimposed by regional uplift is apparent within the city of Vienna covering the transition of the Eastern Alps to the Vienna Basin. Vienna is crosscut by the Leopoldsdorfer Fault System

(LFS), a major Miocene sidewall fault offsetting the alpine basement by around 4500 m. At the surface, the footwall of the LFS is characterized by a well-developed terrace staircase, while at the hanging wall, terrace levels are inconsistent within the regional stratigraphic scheme.

Quaternary normal faulting along the LFS has been proposed but not integratively analyzed from a landscape evolution perspective including stream behavior and uplift.

In a multimethodological approach, involving terrestrial cosmogenic nuclide and luminescence dating, geophysical (ERT) prospection, multiple drill-log and sedimentological analyses, we investigate how regional uplift and local subsidence along the Vienna terrace staircase competingly act since the Late Pliocene. The opposing trends of vertical movement under changing slip rates initially resulted in sediment preservation through local subsidence and subsequently in sediment preservation through surface uplift. Numerical ages record this transition of fluvial aggradation to uplift and terrace formation. Geophysical (ERT) prospection and drill-log analysis suggests sediment deformation and Quaternary fault activity of the LFS. In the light of our results, some previous ideas on terrace stratigraphy in Vienna should be reconsidered. Furthermore, our holistic view allows more consistent statements on tectonic activity and the seismic potential.

Session 5 – Earth Surface Processes and Environmental Change

The loess section of Baix (Rhône Rift Valley, SE-France): a unique paleoenvironmental record from the transition between the temperate and the Mediterranean region of Europe

Sauer, Daniela[1]; **Pfaffner, Nora[1,2]***; Kadereit, Annette[3]; Kreutzer, Sebastian[3]; Wang, Tianhao[1,4]; Karius, Volker[5]; Kolb, Thomas[6]; Bertran, Pascal[7,8]; Bosq, Mathieu[8]; & Hatté, Christine[9]

[1] University of Göttingen, Department of Physical Geography, Göttingen, Germany
[2] Thuenen-Institute, Institute of Forest Ecosystems, Eberswalde, Germany
[3] University of Heidelberg, Institute of Geography, Luminescence Laboratory, Heidelberg, Germany
[4] Shenyang Agricultural University, College of Land and Environment, Shenyang, China
[5] University of Göttingen, Department of Sedimentology and Environmental Geology, Göttingen, Germany
[6] University of Giessen, Department of Geography, Giessen, Germany
[7] Inrap, Bègles, France
[8] PACEA, Université de Bordeaux-CNRS, Pessac, France
[9] Laboratoire des Sciences du Climat et de l’Environnement (LSCE), Université Paris Saclay, Gif-sur-Yvette, France
* Corresponding author: nora.pfaffner@thuenen.de

Loess-palaeosol successions (LPS) provide valuable archives of Quaternary palaeoenvironmental changes. Here we present the LPS Baix, located at the western edge of the Rhône Rift Valley, at 44°42’36’’ N. It was discovered already in 1934 (Suen, 1934), but has never been studied by modern analytical methods. This LPS caught our attention, because it is located just at the transition between the temperate and Mediterranean region. Our aim was to decipher the paleoenvironmental record of the LPS Baix in this particular climatic position. To our knowledge, no LPS has been analysed yet in this position, which could potentially provide a link between the LPS in the temperate regions further north, and LPS in the Mediterranean region. We analysed the 14 m thick LPS Baix by sedimentological and palaeopedological methods, combined with OSL screening and ^{14}C dating of mollusc shells. Reddish Btg horizons of a Stagnic Luvisol at the base of the LPS represent the remains of an MIS 5 pedocomplex (Fig. 1). Two Bw horizons of brown Cambisols have been preserved in MIS 5a/4 and MIS 3 deposits. The upper one is associated with large carbonate nodules in the underlying loess unit. No palaeosols were observed in the MIS 2 deposits.

Fig. 1: *A) LPS Baix. B) Carbonate nodules at base of MIS 3 Cambisol. C) Fe-Mn nodules and D) bleached root channel in MIS 5 Stagnic Luvisol. E) Columns for high-resolution OSL-screening (Photos: D. Sauer, 2020).*

References

Suen, T.-Y., 1934. Le loess de la vallée du Rhône. (Ph.D. Thesis). Faculté des Lettres de l'Université de Lyon, Lyon.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Leipzig, city in a state of flux. Urban-fluvial symbiosis in a long-term perspective

Schmidt, Johannes[1*]; Schmidt-Funke, Julia[2] & Hardt, Matthias[3]

[1] Leipzig University, Institute of Geography, Leipzig, Germany
[2] Leipzig University, Historical Smeinar, Leipzig, Germany
[3] Leibniz Centre for History and Culture of Eastern Europe (GWZO), Department “Humans and Environment”, Leipzig, Germany
* Corresponding author: j.schmidt@uni-leipzig.de

Leipzig, today a metropolis with 600.000 inhabitants, originated in the Middle Ages at the edge of the Pleiße and Weiße Elster floodplain. The place gave the city its name, which derives from Indo-European *Leibh-, meaning watery, slippery, loamy area. At least since the 12th century, Leipzig’s inhabitants engaged in water engineering methods in order to secure water provisioning and allow for the use of water power and waterways. This led to an anthropogenic transformation of the existing waterbodies, which shaped the city for centuries. While the close connection between city and water tended to disappear in the 20th century, it is being rediscovered today through town planning, tourism and nature conservation.

With its varied water history, Leipzig is a particularly well-suited case study for investigating the interdependencies between humans and water in the sense of a “fluvial anthroposphere”. The city is characterised by a dense network of smaller water courses, a still-existing riparian forest, and a high density of archival sources, provided by both cultural and natural archives. The project takes a long-term perspective,

investigating the period between 1000 and 1800, and combines historical, archaeological and geoscientific analyses. Its main objectives are (1) hydrological dynamics and city politics, (2) floods and droughts as social-natural events, (3) urban water pollution and (4) floodplain economies. Within the Priority Programme “On the Way to the Fluvial Anthroposphere” it stands for a decisive urban approach that provides the basis for drawing out the specifics of an urban-fluvial anthroposphere.

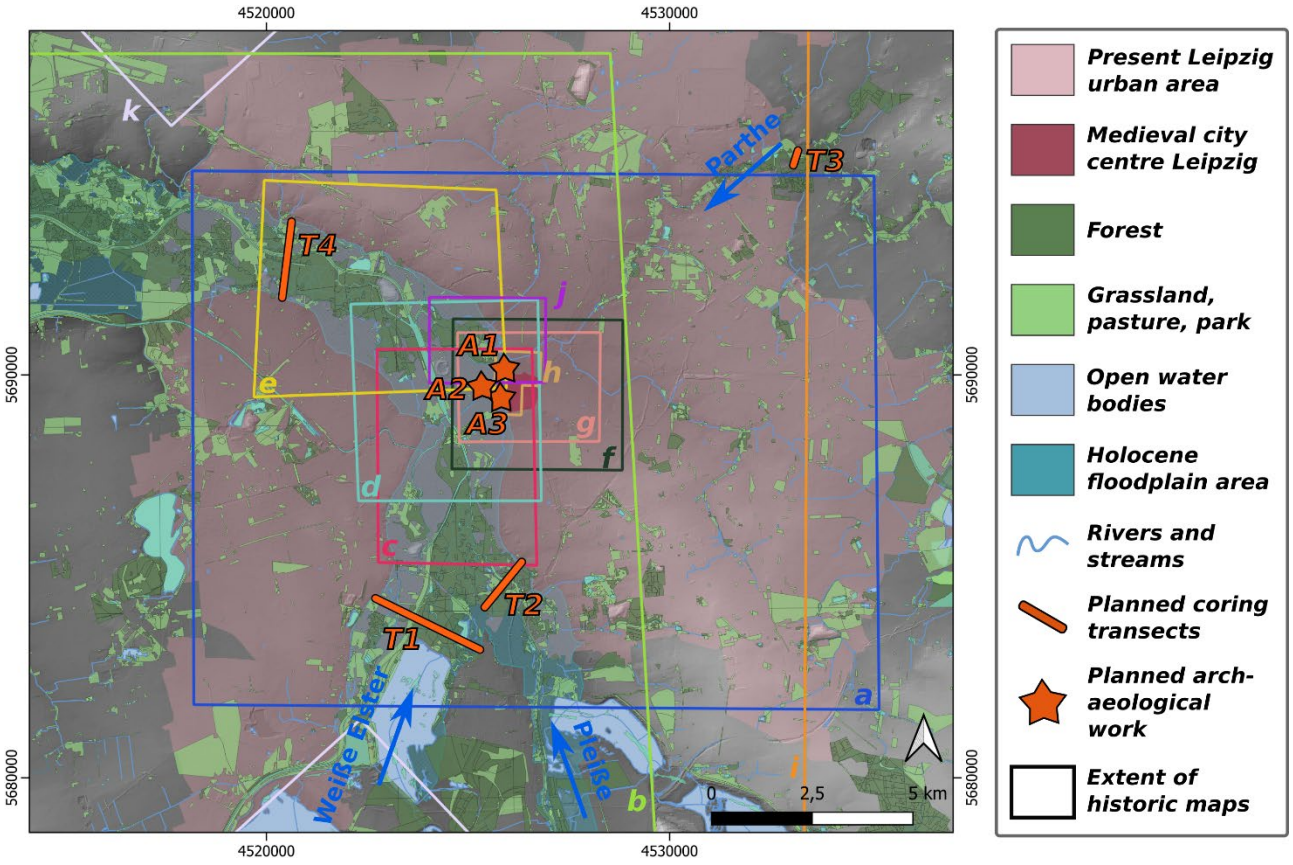

Fig. 1: *Map of the study area with geomorphological, ecological and structural base information. Coloured rectangles show the extent of a first set of georeferenced historical maps or palaeo-surface models: a - City map 1808 “Neuer Plan von der Stadt Leipzig mit den Vorstädten nebst der umliegenden Gegend”, b - Map of water courses and settlements c. 1770 “Weiße Elster von Crossen bis Schkeuditz sowie andere Wasserläufe [...]” (Leipzig Municipal Archives), c - Floodplain map 1682 “Ein kurtzer Abriß der beyden Wasser-Ströhme als die Pleiß und Elster [...]” (Leipzig City Museum), d - Map drawing of the floodplain without year (Leipzig Municipal Archives), e - Map of the floodplain after passing Leipzig 1769 “Geometrischer Grundriss des Wassers der Elster und Luppe, von der Angermühle [...]” (Leipzig Municipal Archives), f - City map Leipzig 1864 “Leipzig und die im Osten angrenzenden Dörfer”, g - Map of Leipzig 1788 “Grundriss der Chursächsischen Handelsstadt Leipzig” , h - Palaeo-surface model “1015” Grimm & Heinrich 2019, i - Map of rafting trenches 1748 “Plan derer Gewässer Flüsse so bey Leipzig ab und zu lauffen” (Leipzig Municipal Archives), j - Map of Rosenthal area c. 1780 “Grundriss des Rosenthals bey Leipzig” (Leipzig Municipal Archives), k - “Meilenblätter von Sachsen, Berliner Exemplar”, for the study area mapped 1801-1806. Ordnance survey maps (“Messtischblätter”), for the study area mapped 1922-1942, cover the whole study area and are not displayed separately. Organe lines show the position of the planned coring transects crossing the major rivers before passing Leipzig (T1 - Weiße Elster floodplain, T2 - Pleiße floodplain, T3 - Parthe floodplain) and a confluenced floodplain section after passing Leipzig at sub-regional scale (T4). Orange stars show planned construction works with official archaeological accompanying work (A1 - Parthe floodplain, Zoo Leipzig 2021; A2 - Elstermühlgraben, Julke 2021; A3 - Pleißemühlgraben, Julke 2017).*

Session 5 – Earth Surface Processes and Environmental Change

The importance of loess stratigraphy for soil geography in Saxony

Sinapius, Ralf[1]*

[1] Freelancer Geologist, Voigtsdorf, Germany
* Corresponding author: sinapius@bodenwissenschaft.de

Saxony is a hotspot of different loess soils (soils in the sense of KA5 up to 2 m deep). The loess regions of Saxony are located north of the low mountain ranges and run from the Leipzig lowland bay to Lower Silesian Upper Lusati. The east-west distance is about 200 km, the north-south extension varies between 30-40 km in width. The loesses in Saxony are formed according to altitude and exposure. The different loess soils exist as a north-south sequence as well as an east-west sequence of characteristic pedosequences. Soil classes (KA5) of black earth, lessivé, brown earth and pseudogley largely occur. Especially the Westelbian loess area shows, even within short distances, a high range of Chernosem, Parabraunerde, Fahlerde and Pseudogley subtypes. These heterogeneous complex pedosequences are basically determined by the occurrence of different loess layers including LPS.

The loess stratigraphy of Saxony was established by Lieberoth 1963 (RII, Wα, β, γ-loess) and further developed by Meszner 2015. According to Meszner 2015, 5 loess packages exist from Saale to the end of the pleniglacial (Unit I -V). For the surface soil mapping in the sense of KA5, the Lieberoth classification has a high field geological relevance, since a detailed strata and horizon characterisation with stratigraphic parallelisations was carried out on the basis of numerous outcrops of different loess regions (Lieberoth 1963).

The loess soils (KA5 to 2 m) show typical ratios in the silt fraction. These reflect the stratigraphy and geographical position. The periglacial climate decisively shaped the lithology of the loess layers (Meszner 2015). The specific occurrence of the Saalian and Weichselian loess sequences with their different lithologies predetermines the soil mosaic in the main pedogenetic directions. Two poles of pedofacies-types exist:

- A primary loess pedofacies type with soils of black earth – lessivé type, whose distribution is connected to the high-glacial, slightly weathered calcareous loess (Unit II).

- A "Lommatzsch-Gleina" facies type with soils of Lessivé-Pseudogley type, very common are Fahlerde-Pseudogley transitional forms. The distribution of these types is connected to the Saalian to early Weichselian loess (Unit III – V) of the Lommatzsch soil complex (Lieberoth 1963) and the Gleina complex (Meszner 2015, Lieberoth 1963) and a simultaneous lack of primary loess (Unit II).

Between these pedogenetic poles, further characteristic sequences and diverse complex combinations exist. The climageographic approach to explainthe superficial loess soils (Richter et al 1970) is only partially valid. The specific distribution of the lithologically different loesses is decisive for the loess-soil-mosaic in Saxony.

Soil profiles and analytics are presented, ranging from the (presumably) Saalian loess to the youngest high glacial Weichselian loess and originating from the soil exploration programme of Saxony and other projects.

References

Lieberoth, I., 1959. Die Lamellenfleckenzone, in: Beobachtungen im Nordsächsischen Lössgebiet. Zeitschrift für Pflanzenernährung, Düngung und Bodenkunde 86, 146 – 155.

Lieberoth, I., 1963. Lößsedimentation und Bodenbildung während des Pleistozäns in Sachsen. Zeitschrift für Geologie 2, Jahrgang 12, Akademie-Verlag Berlin.

Meszner, S., 2015: Löss in Sachsen. Rekonstruktion der spätpleistozänen Landschaftsentwicklung und Paläoumwelt anhand von Löss-Paläobodensequenzen aus Sachsen (Deutschland). Diss. TUD Dresden.

Richter, H., Haase, G., Lieberoth, I., Ruske, R. (Hrsg.), 1970. Periglazial –Löß –Paläolithikum im Jungpleistozän der Deutschen Demokratischen Republik. Petermanns Geographische Mitteilungen, Erg. Heft Nr. 274, 99-202.

https://www.boden.sachsen.de/fachinformationssystem-boden

Fig. 1: *The lamellar stain zone (Lieberoth 1959) of the youngest loess (Unit I / Meszner 2015) has a soil geological guiding function and is found in various loess regions of Saxony, here near Dresden.*

Session 2 – Abrupt Climate Change and Extreme Events

A mechanistic approach for interpreting hydroclimate from halite-bearing sediments during abrupt climatic transitions

Sirota, Ido [1,2*]; Armon, Moshe [1,3]; Ben Dor, Yoav [1,2]; Morin, Efrat [1]; Lensky, Nadav G. [1,2] & Enzel, Yehouda [1]

[1]The Fredy and Nadine Herrmann Institute of Earth Sciences, Edmond J. Safra Campus, The Hebrew University of Jerusalem, Givat Ram, Jerusalem, 91904, Israel
[2]Geological Survey of Israel, 32 Yesha'ayahu Leibowitz, Jerusalem 9692100, Israel
[3]Institute for Atmospheric and Climate Science, ETH Zurich, Universitätstrasse 16, CH-8092 Zurich, Switzerland
* Corresponding author: ido.sirota@mail.huji.ac.il

Establishing accurate paleo-hydroclimatic reconstructions from lacustrine and marine archives is a long-standing challenge in paleoenvironment studies. Closed-basin evaporites and especially halite record episodes of extremely arid conditions during rapid climate change. However, the complex limnologic behavior of deep hypersaline water bodies and the stochastic hydroclimatic regime and its variations limit detailed paleo-hydroclimatic interpretations from such records. Therefore, we developed a mass-balance model to explore hydrology-limnology-sedimentology relationships in hypersaline environments under both deterministic and stochastic approaches that generate synthetic halite-mud sequences. Applying the model to the Holocene Dead Sea halites yields novel insights on paleoenvironmental conditions in the Levant. The deterministic framework indicates that (i) under a series of similar hydroclimatic cycles, the thickness of each subsequent halite interval decreases, due to the depletion of dissolved ions storage in the brine. (ii) Halite deposition requires lake levels drop to below the minimal lake level of the preceding cycle. (iii) The time interval between halite deposition and the hydrologic minimum is increasingly delayed in subsequent cycles. Thus, counter-intuitively, halite deposition mostly takes place as water discharge increases, providing that the water balance is still negative. The stochastic approach produced random sequences comparable to the observed Dead Sea sedimentary record. It demonstrates that some hydrologic minima are not represented

by halite deposition at all. Furthermore, the thickness and number of halite beds at each hydrologic cycle vary substantially, depending on the specific hydrologic conditions realized. Finally, our results imply that the major deglaciation, pre-Holocene (~14 ka BP) Dead Sea level drop, previously assumed to be a record minimum, could not have been as pronounced as suggested, and must have been milder than the subsequent drop at the early Holocene (~11–10 ka BP).

Session 5 – Earth Surface Processes and Environmental Change

Record of soil creep on a forested mountain slope using dendrochronological and ERT methods – an example from the Outer Western Carpathians (southern Poland)

Sitko, Katarzyna[1,2]*; Kondracka, Marta[2]; Wistuba, Małgorzata[2] & Malik, Ireneusz[2]

[1] Institute for Ecology of Industrial Areas, Katowice, Poland
[2] University of Silesia in Katowice, Faculty of Earth Sciences, Sosnowiec, Poland
* Corresponding author: katarzyna_luszczynska@o2.pl

Slope-shaping research is a topic frequently undertaken in geomorphological research, but soil creeping on forested mountain slopes has received little attention. Earlier studies have shown that on forested slopes the rate of soil creep is minimal or zero (e.g. Jahn 1989), however, this process is one of the elements of denudation, which in the long term may cause the displacement of the weathered cover and, consequently, the lowering of the slopes. Characteristically deformed tree stems – tilted and bent under the influence of ground movement – may indicate the impact of soil creep on forested slopes. Each tree growing on the studied area is a separate sensor of the ground motion, which allows to analyse the temporal and spatial variability of the course of geomorphological processes. Trees growing in the area affected by geomorphological processes are subject to mechanical stress, which is recorded in the form of anatomical changes: development of eccentricity growth and reaction wood.

The Hasztuba study site is located in the Beskidy Śląskie Mts, southern Poland, the Outer Western Carpathians. The selection of the study site was preceded by the analysis of geological maps, land cover and digital terrain model from LiDAR data. A gently sloping slope was selected for the study, made mainly of red and green slate with inserts of thick-bed sandstones. At the same time, the characteristic, ragged morphology with small forms as well as tilted tree stems allowed for preliminary identification of traces of soil creep. The studied slope was divided into zones within which various deformations of tree stems were observed. The samples were taken from 20 Norway spruce trees by sampling two cores from one tree. The growth eccentricity and the structure of normal and reaction wood were studied. Measurement of tree-ring widths and calculation of eccentricity index for individual tree rings made it possible to date events of soil creep with an accuracy of one year (after: Wistuba et al. 2013). The reaction wood was analysed visually under a binocular using the criteria proposed by Yumoto et al. (1983). Electrical resistivity tomography (ERT) method was used to identify the deep soil at the Hasztuba site by performing 4 ERT profiles: one long profile (600 m) and tree short profiles (40 m, 20 m, 20 m).

Acknowledgements. The research was supported by the Polish National Science Centre through grant no. 2017/25/N/ST10/01716.

References

Jahn, A., 1989. The soil movement in different altitudinal and ecological zones of Sudetes Mountains. Geografiska Annaler 71A (3–4), 161–170.

Wistuba, M., Malik, I., Gärtner, H., Kojs, P., Owczarek, P. 2013. Application of eccentric growth of trees as a tool for landslide analyses: The example of *Picea abies* Karst. in the Carpathian and Sudeten Mountains (Central Europe). Catena 111, 41–55.

Yumoto, M., Ishida, S., Fukazawa, K., 1983. Studies on the formation and structure of the compression wood cells induced by artifactual initiation in young trees of Picea glauca. IV. Gradation of the severity of compression wood tracheids. Research Bulletins of the College Experiment Forests, 40(2), 409–454.

Session 1 – Climate variability and warmer climates

On the forcing of glacial abrupt climate transitions of the last 300,000 years

Skiba, Vanessa[1*]; Trüssel, Martin[2]; Plessen, Birgit[3]; Spötl, Christoph[4]; Tjallingii, Rik[3]; Eichstädter, René[5]; Schröder-Ritzrau, Andrea[5]; Braun, Tobias[1]; Mitsui, Takahito[1,6]; Frank, Norbert[5]; Boers, Niklas[6]; Zhang, Xu[7]; Marwan, Norbert[1] & Fohlmeister, Jens[1,3,8]

[1] Potsdam Institute for Climate Impact Research (PIK), Potsdam, Germany
[2] NeKO-Stiftung, Naturerbe Karst und Höhlen Obwalden, Switzerland
[3] German Research Centre For Geosciences (GFZ), Potsdam, Germany
[4] Quaternary Research Group, University of Innsbruck, Innsbruck, Austria
[5] Physics of Environmental Archives, University of Heidelberg, Heidelberg, Germany
[6] School of Engineering and Design, Technical University of Munich, Munich, Germany
[7] Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Peking, China
[8] German Federal Office for Radiation Protection (BfS), Berlin, Germany
* Corresponding author: skiba@pik-potsdam.de

Abrupt stadial-interstadial transitions, are a prominent feature of the last glacial as recorded in Greenland ice core records (Dansgaard-Oeschger events). Event abruptness and presence of statistical early warning signals before these transitions indicate that they involve crossing of a tipping point of the climate system. However, only little information is available for periods before the last glacial period as Greenland ice cores and many other high-resolution records do not extent beyond the last glacial cycle. Given the lack of understanding of the triggering mechanisms responsible for glacial abrupt climate transitions with palaeoclimate data from the last glacial, it is essential to investigate this phenomenon during earlier glacial periods.

Here, we present a new highly resolved, precisely U-Th-dated speleothem oxygen isotope record from the Northern European Alps for the penultimate glacial (MIS7-MIS8), a region which has been shown to record similar climate variability as Greenland ice core records. Together with previously obtained speleothem data from this cave site for MIS5-MIS7 and Greenland ice core data (NGRIP, MIS1-4), we investigate background climate conditions which favour occurrence of abrupt climate transitions using regression analysis. Besides intermediate background conditions (sea level, CO_2 and CH_4) and low precession, we find either relatively low or high obliquity to favour glacial abrupt climate transitions, perhaps depending on the initial mode of the Atlantic Meridional Ocean Circulation before these occurrences.

Session 3 – Synchronisation and Dating of Proxy Records

Novel multi-proxy approaches for synchronization of European palaeoclimate records from the Holstein interglacial - project concept

Słowiński, Michał[1,*]; Brauer, Achim[2]; Nitychoruk, Jerzy[3]; Czymzik, Markus[4]; Sachse, Dirk[5]; Lauterbach, Stefan[2]; Tjallingii, Rik[2]; Mroczkowska, Agnieszka[1]; Polkowski, Tomasz[1]; Theuerkauf, Martin[6]; Łuców, Dominika[1]; Halaś, Agnieszka[1]; Błaszkiewicz, Mirosław[7]; Szewczyk, Krzysztof[1]; Czajkowska, Monika[8]; Obremska, Milena[9] & Koutsodendris, Andreas[10]

[1] Institute of Geography and Spatial Organization Polish Academy of Sciences, Past Landscape Dynamics Department, Warszawa, Poland
[2] GFZ German Research Centre for Geosciences, Section Climate Dynamics and Landscape Evolution, Telegrafenberg, Potsdam, Germany
[3] Pope John Paul II State School of Higher Education in Biała Podlaska, Poland
[4] Marine Geology, Leibniz Institute for Baltic Sea Research Warnemünde, Rostock, Germany
[5] GFZ German Research Centre for Geosciences, Section 4.6 Geomorphology, Telegrafenberg, Potsdam, Germany
[6] University of Greifswald, Institute of Botany and Landscape Ecology, Greifswald, Germany
[7] Institute of Geography and Spatial Organization Polish Academy of Sciences, Department of Environmental Resources and Geohazards, Toruń, Poland
[8] UniversityofWarsaw, FacultyofGeology, Warszawa, Poland
[9] Institute of Geological Sciences, Polish Academy of Sciences, Warsaw, Poland
[10]Paleoenvironmental Dynamics Group, Institute of Earth Sciences, University of Heidelberg, Heidelberg, Germany
* Corresponding author: michal.slowinski@geopan.torun.pl

Abrupt climate events are an important part of Holocene (MIS 1) climate variability, which is characterize by sudden shift in global climate temperatures that have triggered environmental regime shifts and human populations like 8.2, 4.2 or 2.8 ka BP events. Therefore, for example, Holsteinian interglacial (MIS 11) older than the Holocene, previous interglacial have now become an valuable scientific research goal, because only with a reference point we can differentiate and understand the impact of anthropopression in the Holocene and what role man plays in climate evolution.

Abundant records of Holsteinian interglacial (MIS 11), which are good Holocene analogue occur across Europe and allow this to be investigated. During the Holsteinian Interglacial, which began approximately 410,000 years ago and lasted in total for some 30,000 years 12 a short cooling period, the so called Older Holsteinian Oscillation (OHO) took place. The OHO climate oscillation was rather abrupt and lasted for ~200-300 years, characterized by a decrease in temperature and moisture availability. Wider implication in terms of published material of the results climatic events around OHO it living within the interglacial, the MIS 11 abrupt event is directly comparable to the 8.2 ka event it is likely that the MIS 11 event was triggered by similar driven factors. Furthermore, in continental records of the Holsteinian a second abrupt event, Younger Holsteinian Oscillation (YHO) occurs 3000 to 4000 years later in the interglacial if the correlation and similarities are corrected then the timing of this second event would be close to the global ice minimum of the interglacial approx. 404 ka. The main aim of this project is to trace in detail the succession of climatic conditions at the time of two abrupt cooling events during the Holsteinian Interglacial in order to examine their spatial extents and temporal patterns across Europe.

Studying the spatiotemporal characteristics of short-term climate variability in the past needs precise chronologies and 'climate independent' synchronization tools, that allow direct comparison of proxy records from different paleoclimate archives. Annually laminated (varved) lake sediments are ideal archives for high-resolution studies of past climate variability. However, varved lake sediment records which cover the Holsteinian interglacial are rare in the Europe. That's why we would like to focus on two known laminated sediment records from Eastern Europe – Ossówka paleolake (Nitychoruk et al., 2005) and Western Europe – Dethlingen (Koutsodendris et al., 2013), (Fig. 1). Planned as part of the project is a high-resolution paleoenvironmental reconstruction and the establishment of independent chronologies for both records that will enable the determination of spatial and temporal climatic changes and continentality gradients from the

western towards the eastern archive during the OHO and YHO. We plan to apply novel multi-method approaches to carry out the proposed research. High-resolution 5-10 years temporal resolution biological proxies (pollen, Chironomidae, Cladocera and diatoms), geochemical data (µ-XRF element scans), terrestrial biomarkers and their stable hydrogen isotope (δDwax) will be applied y to reconstruct atmospheric responses to rapid climatic and environmental changes during climatic events around OHO and YHO in Holsteinian interglacial (MIS 11).

References:

Koutsodendris, A., Lotter, A. F., Kirilova, E., Verhagen, F. T. M., Brauer, A., & Pross, J. (2013). Evolution of a Holsteinian (MIS 11c) palaeolake based on a 12-ka-long diatom record from Dethlingen (northern Germany). Boreas, 42(3), 714-728. https://doi.org/10.1111/bor.12001.

Nitychoruk, J., Bińka, K., Hoefs, J., Ruppert, H., & Schneider, J. (2005). Climate reconstruction for the Holsteinian Interglacial in eastern Poland and its comparison with isotopic data from Marine Isotope Stage 11. Quaternary Science Reviews, 24(5-6), 631-644. https://doi.org/10.1016/j.quascirev.2004.07.023.

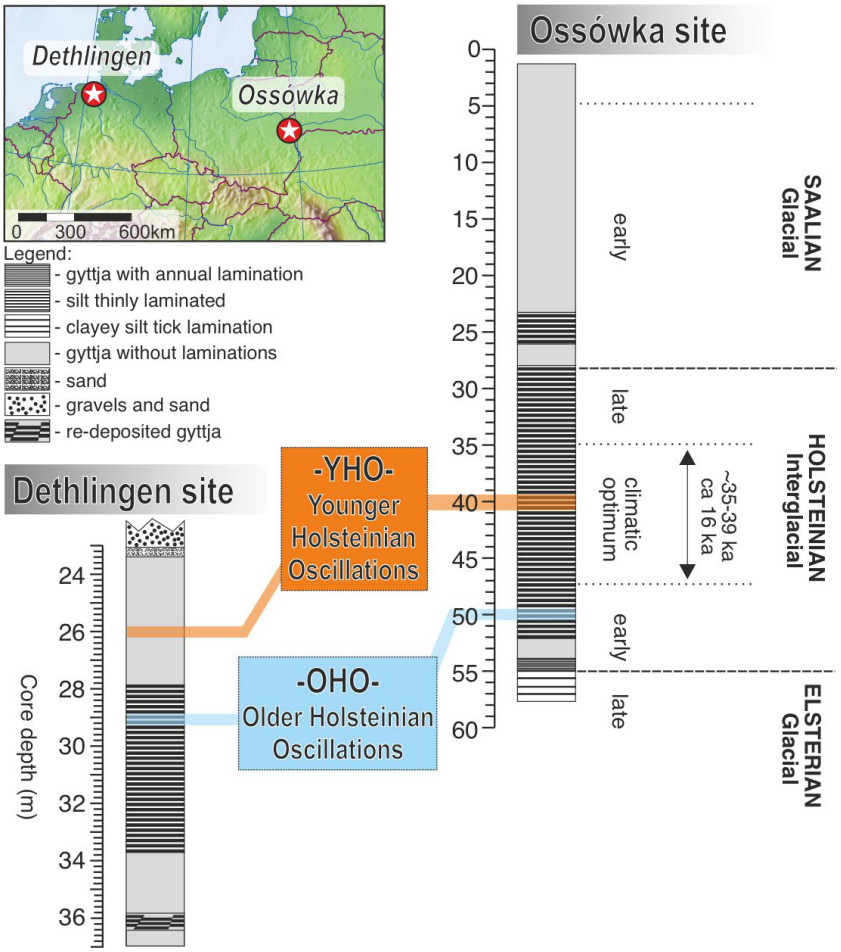

Fig. 1: *Lithological correlation of annually laminated lake sediments from the Holsteinian interglacial in the Dethlingen site (Germany) and Ossówka site (Poland) and position of the OHO and YHO in both sites.*

Session 5 – Earth Surface Processes and Environmental Change

Age, composition and genesis of sandy loess deposits (Sandlöss) in the Hoher Fläming (south-west Brandenburg, Germany) – first results

Starke, Joris[1]*; Bauriegel, Albrecht[2]; Hardt, Jacob[1]; Kirsten, Fabian[1]; Lüthgens, Christopher[3] & Sinapius, Ralf[4]

[1] Freie Universität Berlin, AG Physische Geographie, Berlin, Germany
[2] Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (LBGR), Cottbus, Germany
[3] Universität für Bodenkultur Wien, Institut für Angewandte Geologie, Wien, Austria
[4] Büro für Bodenwissenschaft, Freiberg, Germany
* Corresponding author: joris.starke@fu-berlin.de

The Fläming is a hilly plateau in the south-western part of Brandenburg (NE-Germany) stretching in a north-western to south-eastern direction. It reaches a maximum altitude of about 200 m a.s.l.. It was mainly formed during the Warthe stage of the Saale glaciation as a terminal moraine complex. As a result, several push moraines as well as extensive areas covered by glacio-fluvial sands of varying thickness can be found at the surface (Stackebrandt 2020). During the Weichselian, the Scandinavian ice shield (SIS) did not reach the Fläming, even during the maximum ice extent (L-LGM). Under periglacial conditions, the glacial relief was transformed into its late Pleistocene/Holocene morphology and aeolian sediments with sandy to silty composition were deposited.

These sandy loess deposits are also represented in current maps of loess distributions in Central Europe (Bertran et al. 2021; Lehmkuhl et al. 2021). However, to our knowledge, the deposits of Fläming have never been studied in detail regarding provenance, composition and timing of deposition. Early descriptions including grain size data about sandy to silty calcareous sediments (“Flottsand”) from the 1960s (Brunner 1961; Fiedler und Altermann 1964; Nebe et al. 1962) based on extensive fieldwork in the area have unfortunately not led the path for further research so far. According to the soil map of Brandenburg, the study area is characterized by decalcified sandy loess deposits with a thickness of usually well below 100 cm. Lessivés/Luvisols (“Fahlerden”) are the typical soil formation found in these substrates.

Here, we present first results for a sandy loess section of more than 4 meters thickness including a Late Pleistocene/Holocene soil formation (Fahlerde) reaching down to a depth of about 160-180 cm below surface as well as a potential Pleistocene paleosoil at about 200 cm depth. The layers below these soil formations are comprised of (primary) calcareous sandy loess, underlain by glacio-fluvial sands below a depth of about 440 cm. First grain size analyses show that the sandy loess deposit is well sorted with a distinct peak in the coarse silt fraction between 30 and 40 µm and another small peak in the medium sand fraction around 400-500 µm. Interestingly, this grain size distribution is very similar to the that of loess-paleosoil sequences at Hecklingen and Zilly in Sachsen-Anhalt about 80-100 km further west in the heartland of loess distribution north of the Harz mountains (Krauß et al. 2016; Schmidt et al. 2021).

It is one of our main research questions whether these sandy loess deposits of Hoher Fläming can be parallelized to the loess deposits of Sachsen-Anhalt regarding timing, geochemical composition, and provenance. As we assume the underlying well-stratified (glacio-)fluvial sands to be of Saalian age, question regarding the timing of their deposition as well as the timing of the first aeolian deposits on top of them will be addressed. Furthermore, the profile comprises at least one clearly distinguishable paleosoil-horizon of unknown age below the Holocene soil formation.

So far, the deposits discussed here form the most extensive archive of calcareous deposits in the area of Hoher Fläming and therefore represent a valuable asset regarding late Pleistocene and Holocene landscape formation and pedogenesis.

Fig. 1: *Upper part of Profil Rab1 composed of sandy loess near Rabenstein in Hoher Fläming (© F. Kirsten).*

References

Bertran, Pascal; Bosq, Mathieu; Borderie, Quentin; Coussot, Céline; Coutard, Sylvie; Deschodt, Laurent et al. (2021): Revised map of European aeolian deposits derived from soil texture data. In: *Quaternary Science Reviews* 266, S. 107085. DOI: 10.1016/j.quascirev.2021.107085.

Brunner, Horst (1961): Eisrandlagen und Vereisungsgrenzen im Hohen Fläming. In: *Beihefte zu Zeitschrift Geologie* 10 (31), S. 1–74.

Fiedler, Hans-Joachim; Altermann, Manfred (1964): Verbreitung, Entstehung und Eigenschaften von Sandlöß ("Flottsand") im Norddeutschen Flachland und angrenzenden Gebieten. In: *Geologie* 13 (10), S. 1199–1228.

Krauß, Lydia; Zens, Joerg; Zeeden, Christian; Schulte, Philipp; Eckmeier, Eileen; Lehmkuhl, Frank (2016): A Multi-Proxy Analysis of two Loess-Paleosol Sequences in the Northern Harz Foreland, Germany. In: *Palaeogeography, Palaeoclimatology, Palaeoecology* 461, S. 401–417. DOI: 10.1016/j.palaeo.2016.09.001.

Lehmkuhl, F.; Nett, J. J.; Pötter, S.; Schulte, P.; Sprafke, T.; Jary, Z. et al. (2021): Loess landscapes of Europe – Mapping, geomorphology, and zonal differentiation. In: *Earth-Science Reviews* 215, S. 103496. DOI: 10.1016/j.earscirev.2020.103496.

Nebe, W.; Altermann, Manfred; Fiedler, Hans-Joachim (1962): Bemerkungen zum Geschiebedecksand. In: *Jb. Staatl. Mus. Mineral. Geol.*, S. 147–155.

Schmidt, Christoph; Zeeden, Christian; Krauß, Lydia; Lehmkuhl, Frank; Zöller, Ludwig (2021): A chronological and palaeoenvironmental re-evaluation of two loess-palaeosol records in the northern Harz foreland, Germany, based on innovative modelling tools. In: *Boreas* 50 (3), S. 746–763. DOI: 10.1111/bor.12510.

Stackebrandt, Werner (2020): Geologie von Brandenburg. Unter Mitarbeit von Dietrich Franke. Stuttgart: Schweizerbart. Online verfügbar unter https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=6274304.

Session 1 – Climate variability and warmer climates

Holocene dust evolution, drought, and fire history at Wildseemoor, northern Black Forest

Steiner, Martin[1*]; Rambeau, Claire[2]; May, Jan-Hendrik[3]; Marx, Samuel[4]; Vogel, Hendrik[5]; Wolters, Steffen[6]; Hille, Aaron[1] & Preusser, Frank[1]

[1] Institute of Earth and Environmental Sciences, University of Freiburg, Albertstraße 23b, 79104 Freiburg, Germany
[2] Laboratoire Image Ville Environnement (LIVE), LIVE - UMR7362 Université de Strasbourg, 3 rue de l'Argonne, 67000 Strasbourg, France
[3] School of Geography, Earth and Atmospheric Sciences, University of Melbourne, 221 Bouverie St, Carlton, VIC 3053, Australia.
[4] GeoQuEST Research Centre – School of Earth and Environmental Sciences, University of Wollongong, NSW 2522, Australia
[5] Institute of Geological Sciences and Oeschger Centre for Climate Change Research, University of Bern, Baltzerstrasse 1+3, 3012 Bern, Switzerland
[6] Lower Saxony Institute for Historical Coastal Research, Viktoriastr. 26/28, 26382, Wilhelmshaven, Lower Saxony, Germany
* Corresponding author: e-mail address: ms1280@uranus.uni-freiburg.de

Peat mires are excellent archives that allow to reconstruct fire history and dust flux evolution, as well as to identify potential droughts that led to reduced accretion of peat during the Holocene. We investigate a variety of bogs in the Black Forest and the Vosges with regard to the above objectives. As a first step, a 6 m sediment sequence was taken from Wildseemoor, an ombrotrophic peat bog located in the Kaltenbronn nature reserve in the northern Black Forest. Chronological control was established by creating age-depth models using the CRAN rbacon package in R, based on seven identified radiocarbon-dated macrofossils. Fire history information was reconstructed by counting the charcoal content of 260 samples under the binocular and calculating the charcoal influx. To gain information on dust deposition at the site, a semi-quantitative elemental distribution for the sequence was obtained using x-ray fluorescence spectroscopy (XRF).

The calculated age-depth models show that the peat sequence covers the last ca. 9,900 years but reveal two phases of reduced accretion or even hiatuses that cannot be detected by logging the deposits. Interestingly, a phase of reduced accretion/hiatus that fits into the timeframe of the lower (more extensive) phase of reduced accretion/hiatus at Wildseemoor (ca. 8,000 – 5,000 cal BP) was also detected at Katzensteig in the southern Black Forest (ca. 7,600 – 5,600 cal BP). This indicates that these phases of reduced accretion or hiatuses are probably due to a regional cause rather than being a local phenomenon. Potential reasons for reduced accretion or hiatuses in peat can be climatic (temperatures outside of suitable range, dry conditions hindering sphagnum growth favouring decomposition) or other extreme events (for example severe wildfires destroying parts of the sequence). Such events may be expected to result in a drastic change in appearance of peat composition indicated by a marker horizon. The absence of the latter implies a change in climate, likely toward drier/warmer conditions, as the likely cause of reduced peat growth. However, the cause and exact timing for these phases of reduced accretion/hiatuses needs to be investigated in more detail.

Considering phases of reduced accretion/hiatuses, charcoal influx and elemental distribution, altogether, the Wildseemoor sequence reveals several periods of potentially enhanced local dust input, increased fire activity, and/or drought events during the past 10,000 years. Combined charcoal and elemental data suggest the onset of strong anthropogenic impact in the region starting from ca. 3,400 cal BP (Fig. 1), through several periods of elevated charcoal influx and a potential increase in local dust inferred by Ti/La ratios. Potentially, elevated dust mobilization and charcoal influx were the result of “forest field cultivation”, a farming technique using burn clearings. Since most publications regarding peat bogs in the Black Forest and the Vosges focus on palynological investigations, it is difficult to compare these findings with results from other sites. To be able to validate and put these findings into a regional context and improve our understanding of the environmental evolution in the Upper Rhine area, further research in additional bogs in the Black Forest and the nearby Vosges massif is critically needed.

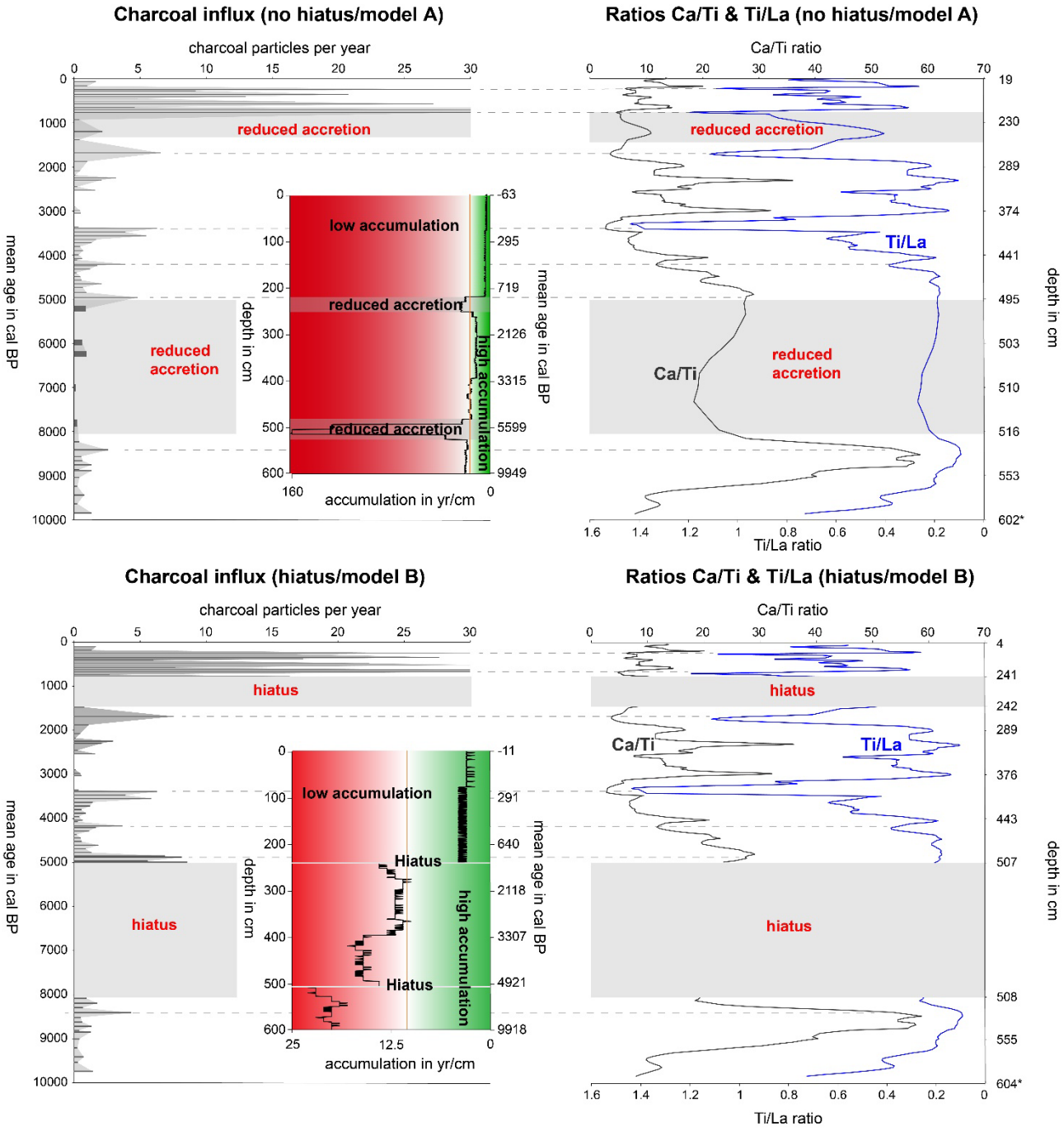

Fig. 1: *Charcoal influx (left) and elemental ratios (Ca/Ti and Ti/La) interpreted as indicators for long-range and short-range dust transport (right) as well as the accumulation rate (centre) for both age-depth models (no hiatus and hiatus scenario).*

Session 2 – Abrupt Climate Change and Extreme Events

Reconstructing hydroclimate extreme events using a high-resolution $\delta^{18}O_{diatom}$ record of Lake Khamra, Siberia

Stieg, Amelie[1*]; Biskaborn, Boris K.[1]; Herzschuh, Ulrike[1, 2, 3]; Airo, Alessandro[4] & Meyer, Hanno[1]

[1] Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Germany.
[2] Institute of Geosciences, University of Potsdam, Germany.
[3] Institute of Biochemistry and Biology, University of Potsdam, Germany.
[4] Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany.
* Corresponding author: amelie.stieg@awi.de

Warming rates in Siberia are among the highest worldwide, but little is known about associated changes in hydrology. Recent drought events resulted in higher salinities of permafrost-affected lake systems, a major threat to local freshwater resources. The overall goal of this project is to understand the relationship between climate warming, hydrological extremes and water quality in natural and human-impacted lakes in Siberia on decadal time-scales. The temporal focus is on the Early and Late Holocene to disentangle the anthropogenic and natural contribution.

Here we present a first high-resolution dataset originated from a natural lake system, Lake Khamra (59.97°N, 112.96°E), located in south-west Yakutia (Russia) in a sparsely populated area. Established from a sediment shortcore, a 220-years, gapless stable isotope record of diatoms ($\delta^{18}O_{diatom}$) is analysed whether hydroclimatic extreme events in Yakutia became more frequent in times of current warming. Energy-dispersive X-ray spectroscopy (EDS) is used to ensure the purity of the sample material for isotope analysis and for contamination correction. Recent stable water isotope data of Lake Khamra included in a calculation of oxygen isotope fractionation between diatomaceous silica and water help to verify the $\delta^{18}O_{diatom}$ measurements. Meteorological data and other proxy climate records are used to identify hydroclimate extreme events and find common driving mechanisms.

Furthermore, diatom assemblages are analysed from the same samples in order to reconstruct changes in the lake’s hydrochemistry, their timing and amplitude in relation to hydroclimatic extreme events. The project will gain substantial knowledge for research on hydroclimate feedbacks to recent global warming and help the local population in Yakutia to better assess potential risks of future climate change on local water resources.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Ergebnisse pollenanalytischer Untersuchungen an saalespätglazialen bis weichselpleniglazialen Sedimenten aus dem Quakenbrücker Becken (Niedersachsen)

Stojakowits, Philipp[1,*]

[1] Landesamt für Bergbau, Energie und Geologie, Hannover, Germany
* Kontakt: Philipp.Stojakowits@lbeg.niedersachsen.de

Eemvorkommen sind aus dem Quakenbrücker Becken schon lange bekannt (z.B. Jonas 1937). In den 1990er Jahren wurden neben dem Eem-Interglazial auch noch saale- und weichselzeitliche Ablagerungen aus der Bohrung „Quakenbrück GE2“ palynologisch untersucht (Hahne et al. 1994). 2021 und 2022 wurden insgesamt 7 Bohrungen aus dem Quakenbrücker Becken bearbeitet, von denen hier die wichtigsten Ergebnisse aus 3 ausgewählten Bohrungen vorgestellt werden.

Die Bohrung Kampe bei Wulfenau enthält von ca. 45 bis 37,7 m Teufe das Saalespätglazial, das sich gemäß Menke & Ross (1969) in eine älteste waldlose Pollenzone A mit reichlich umgelagerten Tertiärelementen, eine Pollenzone B mit dem Aufkommen von *Hippophaë* und eine, wenn auch nur geringfügig aufgelöste Pollenzone C mit *Betula-Juniperus-Hippophaë*-Gebüschen untergliedern lässt. Bis ca. 31,4 m ist das Eem mit den Zonen EI bis EVI sensu Menke & Tynni (1984) repräsentiert. Die Zone EVII fehlt aufgrund eines Hiatus. Die weitere Abfolge umfasst das Herning-Stadial bis ca. 28,2 m Tiefe, gefolgt vom Brörup-Interstadial, das allerdings nur geringmächtig in seiner Frühphase aufgelöst ist und mit dem Montaigu-Ereignis abreißt. Das Rederstall-Stadial, das durch einen hohen Grad an umgelagerten Baumpollenkörnern charakterisiert ist, reicht von ca. 27,6 bis 22,5 m Tiefe. Nach einem pollenleeren Abschnitt dürfte ab rund 18,9 m infolge der regelmäßigen *Selaginella*-Nachweise das Weichsel-Pleniglazial erfasst sein. Bis rund 7,8 m Tiefe verweisen die ausgewerteten Proben aus vermeintlich pollenhöffigen Sedimenten lediglich auf stadiale Verhältnisse. Im Teufenbereich zwischen ca. 7,8 und 7,5 m konnte ein Interstadial erfasst werden. Dem Polleninhalt zufolge könnte es sich um Oerel, Glinde sowie evtl. Moershoofd oder auch Hengelo handeln. Die Radiokarbondatierungen stehen noch aus. Zwischen ca. 6,5 und 6,3 m zeichnet sich ein weiteres Interstadial ab.

Die Bohrung PB19 (Gemeindegebiet Nortrup) enthält neben einem fragmentarisch überlieferten Eem das Herning-Stadial und, sofern im Hangenden des ausgewiesenen Herning-Stadials kein größerer Hiatus vorliegt, das Brörup-Interstadial. Darauf folgen nicht näher einstufbare stadiale Pollenüberlieferungen bis ca. 7,5 m Tiefe. Von 7,5 bis 7,2 m sind interstadiale Bedingungen erfasst (*Betula*-Maximum von 25 %). Solch ein *Betula*-Gipfel findet sich in oerelzeitlichen Abschnitten, jedoch sind vergleichbare *Betula*-Maxima auch aus jüngeren Interstadialen bekannt, wie z.B. während des Glinde-Interstadials, des Moershoofd-Interstadials oder des Hengelo-Interstadials. Die Radiokohlenstoffdatierungen stehen ebenso wie bei der Bohrung KK2 noch aus.

Die Bohrung KK2 (ebenfalls Gemeindegebiet Nortrup) umfasst zwischen ca. 5,4 und 5,1 m Tiefe ein weichselpleniglaziales Interstadial, das neben einem *Betula*-Maximum von ca. 34 % einen zeitgleichen *Salix*-Gipfel von rund 10 % aufweist. Zwischen 4,0 und 3,8 m Teufe ist ein weiteres Interstadial angedeutet.

Literatur

Hahne, J. et al., 1994. Eem-, weichsel- und saalezeitliche Ablagerungen der Bohrung „Quakenbrück GE 2“. Geol. Jb. A134, 9–69.

Jonas, F., 1937. Das Quakenbrücker Interglazial. Botanisches Zentralblatt 57, 343–366.

Session 1 – Climate variability and warmer climates

Ein mittelwürmzeitliches Pollenprofil aus der Erdinger Altmoränenlandschaft (Oberbayern)

Stojakowits, Philipp[1,*]; Preusser, Frank[2]; Mayr, Christoph[3,4]; Peters, Michael[5] & Friedmann, Arne[6]

[1] Landesamt für Bergbau, Energie und Geologie, Hannover, Germany
[2] University of Freiburg, Institute of Earth and Environmental Sciences, Freiburg, Germany
[3] Friedrich-Alexander-University Erlangen-Nürnberg, Institute of Geography, Erlangen, Germany
[4] Ludwig-Maximilians-University München, Department of Earth and Environmental Sciences, Palaeontology and Geobiology, Munich, Germany
[5] Ludwig-Maximilians-University München, Institute for Pre- and Protohistoric Archaeology and the Archaeology of the Roman Provinces, Munich, Germany
[6] University of Augsburg, Institute of Geography, Augsburg, Germany
* Kontakt: Philipp.Stojakowits@lbeg.niedersachsen.de

In der rißeiszeitlich angelegten Erdinger Altmoränenlandschaft wurden mittels einer Liner-Bohrung unter einer ca. 3,4 m mächtigen Löß- und Lößlehmschicht rund 1,4 m mächtige pollenhöffige Ablagerungen geborgen. Der unterlagernde Beckenton ist nahezu pollenleer. Im Hangenden folgen ca. 10 cm Basistorf, 120 cm Gyttja und nochmals rund 10 cm Torf. Das Pollendiagramm lässt sich in fünf lokale Pollenzonen (LPZ) untergliedern. Der basale Diagrammabschnitt (LPZ 1) spiegelt interstadiale Verhältnisse mit dominierendem *Pinus sylvestris*-Typ wider, gefolgt von *Picea*, *Betula* und etwas *Pinus cembra* und *Larix* sowie *Alnus glutinosa*-Typ. Dem Pollenbefund nach herrschte ein lichter borealer Nadelwald vor. In der LPZ 2 ist der Baumpollenanteil deutlich reduziert und der Nichtbaumpollenanteil entsprechend erhöht, darunter Poaceae, *Artemisia* und Caryophyllaceae sowie die aus der Bezugssumme ausgeschlossenen Cyperaceae (92-259 %), ferner auch der Offenlandzeiger *Botrychium*. Während dieses Stadials dürfte eine Tundrenvegetation mit kleineren Waldinseln bzw. Waldtundra an klimatisch begünstigten Standorten verbreitet gewesen sein. In der nachfolgenden LPZ 3 stellten sich wieder interstadiale Bedingungen mit einem aus Koniferen zusammengesetzten, lichten borealen Nadelwald ein, die auch noch während der LPZ 4 andauerten, allerdings mit höherem Offenlandanteil, worauf die gestiegenen Anteile verschiedener heliophytischer Taxa, wie z.B. Poaceae, *Artemisia*, *Thalictrum*, *Helianthemum* und *Selaginella*, verweisen. Die LPZ 5 kennzeichnet eine starke Zunahme der Nichtbaumpollenanteile (v.a. Poaceae und Cyperaceae). Die verbliebenen Waldflächen verschwanden sukzessiv und es breitete sich erneut eine Tundrenvegetation aus. Geochemische Analysen unterstreichen die rekonstruierte Vegetationsentwicklung.

Aus dem oberen Torf (346 und 351 cm Tiefe) liegen zwei Radiokohlenstoffdatierungen mit kalibrierten Altern von 44.640-46.000 a und 44.430-46.750 a vor heute vor (kalibriert mit IntCal20, Reimer et al. 2020). Im Hangenden und Liegenden dieser beiden Datierungen wurden Proben für sechs Lumineszenzdatierungen entnommen, deren Ergebnisse in Kürze vorliegen. Bei der Lokalität Erding handelt es sich somit um einen der wenigen Standorte im süddeutschen Alpenvorland, für den die stadial-interstadiale Klimavariabilität im Marinen Isotopenstadium 3 palynologisch belegt ist.

Literatur

Reimer, P.J. et al., 2020. The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0-55 cal kBP). Radiocarbon 62, 725–757.

Session 5 – Earth Surface Processes and Environmental Change

Potential of sedimentary ancient DNA in reconstructing past arctic ecosystems

Stoof-Leichsenring, Kathleen R.[1*] & Herzschuh, Ulrike [1,2,3]

[1]Polar Terrestrial Environmental Systems, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Potsdam, Germany
[2]Institute for Environmental Science and Geography, University of Potsdam, Potsdam, Germany
[3]Institute for Biochemistry and Biology, University of Potsdam, Potsdam, Germany
* Corresponding author: kathleen.stoof-leichsenring@awi.de

Arctic ecosystems are strongly threatened by recent warming which putatively results in the loss of arctic taxa and the invasion of subarctic taxa into warming areas disequilibrating arctic ecosystems. Looking back to the past enables to track biodiversity changes during former climate shifts like the Late Pleistocene to Holocene transition. Sedimentary ancient DNA (sedaDNA) is a powerful proxy to investigate past biotic composition from arctic sediment core archives in which sedaDNA preservation is favorable. Different methodological approaches that use sedaDNA, like metabarcoding, shotgun and hybridization capture (Fig.1), allow to explore past taxonomic, phylogenetic and functional diversity from population to ecosystem level, which is not possible with traditional microfossil proxies. In our contribution, we exemplify the potential of sedaDNA by applying the various methodologies on different sediment archives from terrestrial Siberian and marine north pacific sites that cover glacial and interglacial phases since the Late Pleistocene. We address different paleoecological questions with a focus on compositional and functional change of terrestrial and aquatic vegetation and associated biotic groups under different climatic phases.

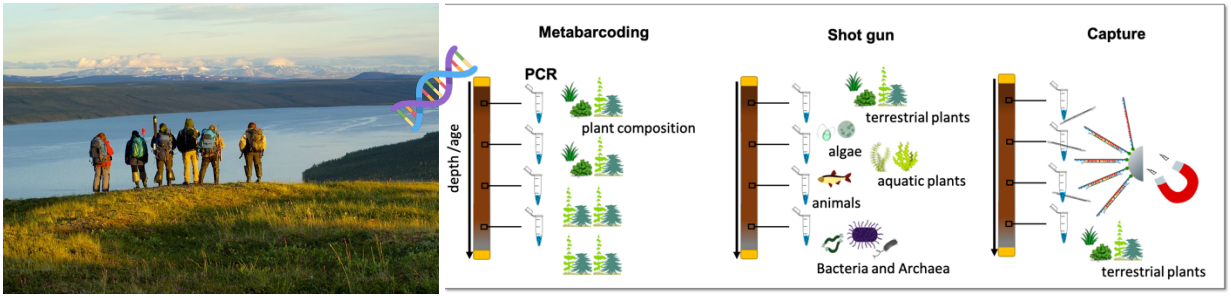

Fig. 1: *Photo from Lake Ilirney, Chukotka, Russia (2018) and schemes of different methodological approaches in sedaDNA research.*

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Die Karte der Holstein-zeitlichen Ablagerungen von Brandenburg 1 : 300 000

Strahl, Jaqueline[1] & Sonntag, Angela[1]

[1] Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (LBGR), Postfach 100933, 03009 Cottbus
* Kontakt: jaqueline.strahl@lbgr.brandenburg.de

Die limnischen und limnisch-fluviatilen Ablagerungen der Holstein-Warmzeit und der an sie anschließenden Fuhne-Kaltzeit besitzen in Brandenburg und Berlin aufgrund der Vielzahl Elster-kaltzeitlich angelegter tiefer Rinnensysteme und großer Paläobecken im Unterschied zur Eem-Warmzeit (Hermsdorf & Strahl 2008) eine flächenhafte Verbreitung. Einzelvorkommen sind selten und in der Regel an kleinräumige Toteisbecken oder Rinnen geringer Tiefe im Bereich Elster-zeitlicher Hochflächen, beispielsweise in Südbrandenburg, gebunden.

Die erste Karte zur „Verbreitung und Tiefenlage der Holstein-Warmzeit und frühsaalezeitlicher Ablagerungen“ wurde im Atlas zur Geologie von Brandenburg im Maßstab 1 : 000 000 publiziert (Zwirner & Ziermann in Stackebrandt 2010). Die aktuelle, im Arbeitsmaßstab 1 : 50 000 erarbeitete Karte 1 : 300 000 basiert auf dem Kartenwerk der Lithofazieskarte Quartär sowie auf mehr als 400 palynostratifizierten Alt- und Neubohrungen, die zur Ermittlung des Tiefenniveaus der Holstein-Unterkante herangezogen wurden. Neben einer damit erreichten deutlichen flächenhaften Erweiterung und Präzisierung der Holstein-Verbreitung erfolgte gegenüber der Atlaskarte auch eine Trennung des limnischen und limnisch-fluviatilen Holstein (u. a. Sperrschicht für Geothermie) vom Elster- bis Unter Saale-zeitlichen Fluviatil (Hauptgrundwasserleiter in Brandenburg), dessen Darstellung in einer weiteren Karte geplant ist. Veröffentlicht wird die Karte einschließlich der nachfolgend aufgeführten Features im Geoportal des Landesamtes für Bergbau, Geologie und Rohstoffe Brandenburg (LBGR) unter https://geo.brandenburg.de/?page=Geologische-Karten, in dem auch die inzwischen revisionsbedürftige Karte der Eem-Vorkommen (Hermsdorf & Strahl 2008) einzusehen ist.

Verfügbar gemacht werden des Weiteren die Schichtenverzeichnisse (GeoDin) der zugrunde gelegten Bohrungen und soweit pollenanalytisch ausgewertet, die Pollendiagramme.

Die Verbreitung des Holstein-zeitlichen Leithorizontes der Paludinenschichten mit ihrer Leitart *Viviparus diluvianus* erfolgt über eine geplante spezielle Bohrungssignatur, teils unterlegt durch die pollenstratifizierten Faunenbefunde (det. S. Meng, Universität Greifswald).

Zudem dargestellt ist die aktualisierte Grenze der Verbreitung marin-brackischer Ablagerungen.

Begleitet wird die Karte durch einen ausführlichen Erläuterungstext, der den derzeitigen Wissensstand zum Holstein Brandenburgs einschließlich neuester Ergebnisse hinsichtlich Paläogeographie, Sedimentations-geschehen, Pollenstratigraphie und Faunenbestand beinhaltet.

Literatur

Hermsdorf, N., Strahl, J., 2008. Karte der Eem-Vorkommen des Landes Brandenburg. Brandenburgische Geowissen-schaftliche Beiträge 15, 1/2, 23–55.

Stackebrandt, W. (Hrsg.), 2010. Atlas zur Geologie von Brandenburg im Maßstab 1 : 1 000 000. Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg, 53.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Zu den Ablagerungen der Dömnitz-Warmzeit im Typusgebiet Prignitz, NW-Brandenburg

Strahl, Jaqueline[1*] & Sonntag, Angela[1]

[1] Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (LBGR), Postfach 100933, 03009 Cottbus
* Kontakt: jaqueline.strahl@lbgr.brandenburg.de

Die flächenhafte Untersuchung der Holstein- und Unter Saale-zeitlichen Ablagerungen in Berlin und Brandenburg unter Einbeziehung von mehr als 400 palynostratifizierten Alt- und Neubohrungen haben schon länger gehegte Zweifel an einer lückenlosen Aufeinanderfolge von Holstein, Fuhne-Kaltzeit und Dömnitz bekräftigt. Dagegen spricht auch der inzwischen erfolgte Nachweis von Vorkommen einer weiteren, zwischen dem Holstein und dem Dömnitz liegenden Warmzeit im niedersächsischen Tagebau Schöningen (Reinsdorf-Warmzeit, Urban 1995, 2007) sowie in Sachsen-Anhalt in Ummendorf (Strahl 2019) und Martinsrieth (Horstwiesen-Warmzeit, siehe Posterbeitrag Wansa, Strahl & Meng).

Die Ablagerungen der Fuhne-Kaltzeit s. str. schließen sich direkt an die Holstein-Warmzeit an und zeigen keinen Anschluss an das Dömnitz. Post-Fuhne-zeitlich wurden durch anhaltende fluviatile Schüttungen die seit der ausgehenden Elster-Kaltzeit aktiven Paläobecken und Rinnen Brandenburgs teils endgültig verfüllt und es fand ein weitestgehender Reliefausgleich statt. Aber auch erosive Prozesse spielten eine wesentliche Rolle, wie prä-Dömnitz-zeitlich bis auf die Oberkante der Elster-kaltzeitlichen Ablagerungen erfolgte Ausräumungen belegen. Ablagerungsräume, in denen eine fortlaufende Stillwasserakkumulation hätte stattfinden können, waren nicht mehr vorhanden oder wurden ausgeräumt. Erst prä-Dömnitz-zeitlich bildeten sich offensichtlich zunächst nur sehr lokal erste Altwasserbereiche, deren stadiale und interstadiale Ablagerungen unterhalb des Dömnitz lagernd beobachtet wurden (Kb Prignitz 1E/93).

Die durch zwei Stadiale und ein zwischengeschaltetes *Betula*-dominiertes Interstadial geprägte und noch nicht näher bezeichnete prä-Dömnitz-zeitliche Kaltzeit ist von den Ablagerungen der Fuhne-Kaltzeit durch mehr als 20 m (!) mächtige Fein- und Mittelsande getrennt. Bis in das Dömnitz hinein unterbrachen wiederholt fluviatile Schüttungen die durch *Azolla filiculoides* belegte Stillwassersedimentation. Wegen des Nachweises dieser Abfolge einschließlich der sie von der Fuhne-Kaltzeit trennenden mächtigen fluviatilen Sande ist ein Hervorgehen des Dömnitz aus dem Spätglazial der Fuhne-Kaltzeit (Erd, 1978) als unwahrscheinlich anzusehen. Vielmehr ist auf eine erhebliche Erosionsdiskordanz zu schließen.

Erst während des Dömnitz kam es zu einem allmählichen Abebben der fluviatilen Tätigkeit und durch Stromlinienverlagerung entstehende Altwasserbereiche konnten sich über längere Zeit erhalten. Die rund 100 Nachweise konzentrieren sich dabei vor allem auf die Prignitz und den Berliner Elbelauf im südlichen Berliner Raum. Das in der Prignitz liegende Typusprofil der Dömnitz-Warmzeit (Kb Pt 1E/61 Erd, 1973, Nebenbohrung Kb Prignitz 1E/93) ist erosiv durch post-Dömnitz-zeitliches Fluviatil gekappt. Das Ende der Warmzeit mit einer *Carpinus-Abies*- und abschließenden Lichtholzphase fehlt.

2004 wurde in der Ortslage Perleberg westlich Pritzwalk im Bereich einer Elster-kaltzeitlichen Hochlage die Bohrung Kb Pe 11/2004 abgeteuft, die neben frühwarmzeitlichen vor allem Ablagerungen des späten Dömnitz sowie einer nachgeschalteten Stadial-Interstadial-Folge erbrachte. Dömnitz-zeitliche Ablagerungen einschließlich seiner Spätphase häufen sich insbesondere im Gebiet der sich nach Norden bis in die Ortslage Karstädt erstreckenden Elster-kaltzeitlichen Hochlage und weisen hier ein dem Eem vergleichbares NN-Niveau außerhalb der Hochlage auf. Das Akkumulationsgebiet blieb auch post-Dömnitz-zeitlich aktiv. Bislang sind nur aus der Prignitz und der Lausitz post-Dömnitz-zeitliche Ablagerungen bekannt. Neben stadialen Sedimenten ist nach dem derzeitigen Bearbeitungsstand innerhalb dieser Abfolge von mindestens 2, wenn nicht sogar 3 Interstadialen auszugehen. Sehr typisch ausgebildet ist das in der Prignitz erste, auf das Dömnitz folgende *Pinus*-reiche Interstadial mit einer charakteristischen Ericaceae-*Alnus*-Ausbreitung. Dieses Interstadial wurde neben dem nördlichsten Vorkommen bei Ortkrug östlich Ludwigslust in Mecklenburg-Vorpommern auch im westlichen Stadtgebiet von Pritzwalk in der Kb Pt 1/75 über spät-Dömnitz-zeitlichen Ablagerungen nachgewiesen, ursprünglich aber als solches nicht erkannt. Die nördlichsten Nachweise der

jüngeren Interstadiale liegen im Grenzbereich zu Mecklenburg-Vorpommern bei Dallmin und Pinnow. Weitere, noch jüngere Ablagerungen des Unter Saale vor dem ersten Saale-Eisvorstoß (Drenthe) sind für Brandenburg bisher nicht bekannt.

Literatur

Erd, K., 1973. Pollenanalytische Gliederung des Pleistozäns der Deutschen Demokratischen Republik. Zeitschrift geologische Wissenschaften 1, 1087–1103.

Erd, K., 1978. Pollenstratigraphie im Gebiet der skandinavischen Vereisungen. Schriften geologische Wissenschaften 9, 99–119.

Strahl, J. 2019. Ergebnisse palynologischer Untersuchungen an der Forschungsbohrung Ummendorf 1/2012 und Vergleich mit anderen pollenstratigraphischen Untersuchungen im oberen Allertal. Mitteilungen zu Geologie und Bergwesen von Sachsen-Anhalt 20, 41–92.

Urban, B., 1995. Palynological evidence of younger Middle Pleistocene Interglacials (Holsteinian, Reinsdorf and Schöningen) in the Schöningen open cast lignite mine (eastern Lower Saxony, Germany). Mededelingen Rijks Geologische Dienst 52, 175–185.

Urban, B., 2007. Interglacial pollen records from Schöningen, north Germany. Sirocko, F., Claussen, M., Sanches-Goni, M. F., Litt, T. (eds.). The climate of past interglacials. Developments in Quaternary Science 7, 417–444.

Wansa, S., Strahl, J., Meng, S., 2022: Die Forschungsbohrung Martinsrieth – ein neues Profil für das jüngere Mittel- und das Oberpleistozän in der Helme-Niederung bei Sangerhausen (Sachsen-Anhalt). Poster DEUQUA-Tagung 2022.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Passive seismische Messungen zur Untersuchung der Quartärmächtigkeiten am Beispiel der Weserterrassen bei Hameln (Niedersachsen)

Thiel, Christine[1*]; Hobiger, Manuel[1]; Beiers, Sandra[2]; Goebel, Björn[1] & Spies, Thomas[1]

[1] Bundesanstalt für Geowissenschaften und Rohstoffe, B4.3 Erdbebendienst des Bundes, Kernwaffenteststopp, Hannover, Deutschland
[2] con terra GmbH, Münster, Deutschland
* Kontakt: christine.thiel@bgr.de

Im Rahmen der Standortcharakterisierung bei ingenieurseismologischen Fragestellungen wird die natürliche seismische Bodenunruhe, sogenannter Mikrotremor, aufgezeichnet und analysiert. Dabei wird das Verhältnis der Amplitudenspektren der Horizontal- zur Vertikalkomponente (H/V-Methode) ermittelt. Diese passive seismische Methode ermöglicht die Bestimmung der Resonanzfrequenz des Untergrundes, aus der bei Kenntnis der Scherwellengeschwindigkeit die Mächtigkeit der aufliegenden Lockersedimente abgeschätzt werden kann (Ibs-von Seht und Wohlenberg, 1999, Chandler und Lively, 2016). Ein Vorteil gegenüber aktiven seismischen Messungen, die in der Quartärforschung häufig eingesetzt werden, ist der reduzierte instrumentelle Aufwand, da nur eine leicht transportable Mikrotremorstation benötigt wird. Durch eine Kombination zahlreicher Punktmessungen kann eine prinzipiell beliebig große Fläche untersucht werden.

Zur Überprüfung der Anwendbarkeit dieser Methode haben wir H/V-Messungen im Gebiet der Hamelner Talweitung (Niedersachsen) durchgeführt. Die dort auftretenden Quartärmächtigkeiten variieren zwischen wenigen Metern im südlichen Teil des Untersuchungsgebietes und mehreren Zehnermetern im nördlichen Teil (vgl. Fleig und Kliem, 1998). Im Bereich des Talbodens befinden sich neben Auelehmen auch Ablagerungen des Niederterrassen-Komplexes, der aus mindestens drei Terrassenstufen besteht (vgl. Schellmann, 1994). Vereinzelt finden sich Reste der Mittelterrasse. Im Liegenden steht Keuper an, welcher auch die Umgrenzung des Wesertales in dem Gebiet darstellt.

Zur Beurteilung der Genauigkeit unserer Analyseergebnisse vergleichen wir die berechneten Mächtigkeiten mit denen aus Bohrkernen (NIBIS®, 2017), die in unmittelbarer Nähe zu den jeweiligen Messpunkten liegen. Abschließend diskutieren wir die Auswertungen vor dem Hintergrund, unter welchen Voraussetzungen die passiven seismischen Messungen zur Vorerkundung von Untersuchungsgebieten genutzt werden können.

Literatur

Chandler, V.W., Lively, R.S., 2016. Utility of the horizontal-to-vertical spectral ratio passive seismic method for estimating thickness of Quaternary sediments in Minnesota and adjacent parts of Wisconsin. Interpretation, 4, 71-90.

Fleig, S., Kliem, B., 1998. Übergroße Quartärmächtigkeiten im Bereich der Hamelner Talweitung bei Tündern. In: Feldmann, L., Meyer, K.-D. (eds) Quartär in Niedersachsen – Exkursionsführer zur Jubiläums-Hauptversammlung der deutschen Quartärvereinigung in Hannover, p. 116-119.

Ibs-von Seht, M., Wohlenberg, J., 1999. Microtremor Measurements Used to Map Thickness of Soft Sediments. Bulletin of the Seismological Society of America, 89, 250-259.

NIBIS®, 2017. Der NIBIS® KARTENSERVER. www.nibis-lbeg.de/cardomap3.

Schellmann, G., 1994. Die Talentwicklung der Oberweser im jüngeren Quartär. In: Schellmann, G. (ed). Beiträge zur jungpleistozänen und holozänen Talgeschichte im deutschen Mittelgebirgsraum und Alpenvorland. Düsseldorfer Geographische Schriften, 34, p. 1-56.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Geochronologische Untersuchungen der Eisrandlagen in Schleswig-Holstein

Thiel, Christine[1*]; Stephan, Hans-Jürgen[2]; Kenzler, Michael[3]; Frechen, Manfred[4] & Grube, Alf[5]

[1] Bundesanstalt für Geowissenschaften und Rohstoffe, B4.3 Erdbebendienst des Bundes, Kernwaffenteststopp, Hannover, Deutschland
[2] privat, Kiel, Deutschland
[3] Universität Greifswald, Institut für Geographie und Geologie, Greifswald, Deutschland
[4] Leibniz-Institut für Angewandte Geophysik, Sektion S3 Geochronologie, Hannover, Deutschland
[5] Geologisches Landesamt, Hamburg, Deutschland
* Kontakt: christine.thiel@bgr.de

In den letzten zwei Jahrzehnten wurden die Untersuchungen und Kartierungen der Weichsel- und Saale-zeitlichen Ablagerungen in Schleswig-Holstein durch Probenentnahmen zur Datierung mittels optisch stimulierter Lumineszenz (OSL) begleitet. Insgesamt wurden hierbei etwa 70 OSL-Proben von mehr als 30 Standorten entnommen und datiert. Im Wesentlichen sollen mit diesen umfassenden geochronologischen Arbeiten drei Fragen geklärt werden:

Zunächst sollen die Weichsel- und Saale-Eisvorstöße klar unterschieden werden. In den vorangegangenen Jahrzehnten war der vermutete äußerste Rand der Weichseleiszeit aufgrund der Ergebnisse der quartärgeologischen Kartierung nach Westen und Süden verschoben worden. Anhand von den OSL-Daten soll die Verlässlichkeit der konstruierten Grenze zwischen Saale- und Weichsel-Gletscherablagerungen in der Landschaft Schleswig-Holsteins beurteilt werden.

Von weiterem Interesse ist, ob es weitere Standorte gibt, welche die Ellund-Phase (MIS 4 bis frühes MIS 3) repräsentieren. Dieser Eisvorstoß ist bisher nur von wenigen Standorten in Schleswig-Holstein bekannt (Marks et al., 1995; Preusser, 1999; Stephan, 2007) und korreliert nach aktuellem Kenntnisstand mit dem Ristinge-Vorstoß in Dänemark (Houmark-Nielsen, 2007) und dem qw0-Vorstoß in Mecklenburg (Warnow-Stadial; Müller, 2004).

Abschließend wird das Ziel verfolgt, die kartierten und nun auch datierten Weichselablagerungen und deren Randlagen eindeutig mit den Eisrandlagen in Mecklenburg und Brandenburg (vgl. Lüthgens et al., 2020 und darin enthaltene Referenzen) zu korrelieren und so zu einem erweiterten Verständnis der norddeutschen Vereisungsphasen beizutragen.

Literatur

Houmark-Nielsen, M., 2007. Extent and age of Middle and Late Pleistocene glaciations and periglacial episodes in southern Jylland, Denmark. DGF, Bulletin of the Geological Society of Denmark 50, 9-35.

Lüthgens, C., Hardt, J., Böse, M., 2020. Proposing a new conceptual model for the reconstruction of ice dynamics in the SW sector of the Scandinavian Ice Sheet (SIS) based on the reinterpretation of published data and new evidence from optically stimulated luminescence (OSL) dating. E&G Quaternary Science Journal 69, 201-223.

Marks, L., Piotrowski, J.A., Stephan, H.-J., Fedorowicz, S., Butrym, J., 1995. Thermoluminescence indications of the Middle Weichselian (Vistulian) Glaciation in Northwest Germany. Meyniana 47, 69-82.

Müller, U., 2004. Weichsel-Frühglazial in Nordwest-Mecklenburg. Meyniana 56, 81- 115.

Preusser, F., 1999. Lumineszenzdatierung fluviatiler Sedimente - Fallbeispiele aus der Schweiz und Norddeutschland. Kölner Forum für Geologie und Paläontologie 3, p. 1-62.

Stephan, H.-J., 2007. Ellund-Formation. - In: LithoLex [Online-Datenbank]. Hannover: BGR. Last updated 2011. Record No. 1006002. http://litholex.bgr.de.

Knowledge transfer

From science to society – on the importance of knowledge transfer in modern science – examples of products and tools

Treffeisen, Renate[1]*& Grosfeld, Klaus[1]*

[1] Alfred Wegener Institute for Polar and Marine Research, Bussestr. 24, 27570 Bremerhaven
*Corresponding authors: renate.treffeisen@awi.de, klaus.grosfeld@awi.de

Climate change is one of the greatest challenges facing humanity in the 21st century. Human influence on the climate system and its repercussions are evident in the increasing atmospheric greenhouse gas concentrations, positive radiative forcing, and the resulting climate warming. Scientific knowledge is essential to provide increasingly detailed scenarios of the impacts of climate change on life and livelihood across the globe. Therefore, the transfer of scientific knowledge regarding this and other impacts of global change is of major concern to society.

The Corona pandemic has shown how important science-based facts and findings are as a basis for decision-making processes. The transfer of scientific knowledge to society requires a high-level translation service combined with well allocated resources. Special emphasis should be placed on working together – stakeholders and the scientific community - to jointly develop and implement new ideas. Another important aspect: this process is bound to yield new research questions.

The Helmholtz climate initiative “Regional Climate Change and Humans (REKLIM)” has been working for more than eleven years on the development of knowledge transfer projects and formats to transfer research results into societal use. After an introductory overview of the meaning and definition of knowledge transfer, we would like to use concrete examples to highlight the process and the unfolding of effects of knowledge transfer projects as well as the problems these projects have to face.

Session 1 – Climate variability and warmer climates

Past temperatures of the Dead Sea during the last deglaciation- Insights from clumped isotope thermometry on authigenic carbonates

Urban, Anaïs[1,2*]; Blanchet, Cecile[2]; Brauer, Achim[2]; Plessen, Birgit[2]; Schwab, Markus J.[2]; Tjallingii, Rik[2] & Ziegler, Martin[1]

[1] Utrecht University, Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands
[2] GFZ German Research Centre for Geosciences, Section Climate Dynamics and Landscape Evolution, Potsdam, Germany
* Corresponding author: anais.urban@web.de

The Mediterranean Sea is referred to as a “climatic hot spot” and warms twice as fast as the global ocean, which bears serious consequences for regional hydroclimates (MedECC, 2020). Past intervals of global warming can help us to pinpoint the processes driving temperature and hydroclimatic changes in order to better manage water resources. The Dead Sea is a terminal lake located in the Eastern Mediterranean, which is an area prone to droughts and extreme rainfall events. In addition, changes in lake levels are directly linked to the precipitation-evaporation balance in its drainage region (Müller et al., 2022). Climate-induced lake level fluctuations in the Dead Sea have been extensively investigated, but changes in lake-water temperature have so far not been reconstructed.

For our study, we use ICDP core 5017-A, which has been extracted from the deepest part of the Dead Sea and covers the last two glacial-interglacial cycles. The investigated time interval of the deglacial warming between 17ka to 11.7ka includes the rapid climatic changes of the H1-event, The Bolling-Allerod warm period and the Younger Dryas. In order to reconstruct past lake-water temperatures, we used the clumped isotope thermometry on authigenic aragonite. Individual aragonite layers were sampled on resin-embedded sediment blocks in varved intervals of the core and will be compared to obtain statistically sound measurements. This innovative technique will be combined with other type of data available or to be acquired for the core, such as XRF scanning, microfacies analysis, stable oxygen isotopes and radiogenic strontium isotopes to provide a hydroclimatic context. Here we present first results and discuss potential interpretations and new insights on temperature changes in the Dead Sea and their impact on hydroclimates during the last deglaciation.

References

MedECC 2020 Summary for Policymakers. In: Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report [Cramer W, Guiot J, Marini K (eds.)] Union for the Mediterranean, Plan Bleu, UNEP/ MAP, Marseille, France, pp 11-40.

Müller, D., Neugebauer, I., Ben Dor, Y., Enzel, Y., Schwab, M. J., Tjallingii, R., & Brauer, A. (2022). Phases of stability during major hydroclimate change ending the Last Glacial in the Levant. *Scientific Reports*, *12*(1), 6052. https://doi.org/10.1038/s41598-022-10217-9

Session 5 – Earth Surface Processes and Environmental Change

Assessing the temperature dependent magnetic susceptibility as a proxy in the depositional context of Lake Bosumtwi (Ghana) by using multivariate statistics

Vinnepand, Mathias[1*]; Zeeden, Christian[1]; Noren, Anders[2]; Asante, Thomas[1]; Kaboth-Bahr, Stefanie[3]; Gosling, William[4]; Kück, Jochem[5] & Wonik, Thomas[1]

[1] LIAG, Leibniz Institute for Applied Geophysics, Section Rock Physics & Borehole Geophysics, Hannover, Germany
[2]University of Minnesota, Continental Scientific Drilling Facility, Minneapolis, USA
[3]University of Potsdam, Institute for Geosciences, Potsdam, Germany
[4]University of Amsterdam, Institute for Biodiversity and Ecosystem Dynamics, Amsterdam, Netherlands
[5]GFZ, German Research Centre for Geosciences, Section Geomechanics and Scientific Drilling, Potsdam, Germany
* Corresponding author: Mathias.Vinnepand@leibniz-liag.de

Lacustrine sediment records are valuable archives of climatic and environmental change. Lake Bosumtwi (Ghana) is of special interest as it provides a long and relatively continuous sediment sequence covering the last 1.07 million years in a potential key region of human evolution during this period. As a hydrological closed basin with ideal geographic position at the interface of competing climate agents such as the Harmattan (hot and dusty winds from the Sahara) and the North African Monsoon, both of which are influenced by the Intertropical Convergence Zone, Lake Bosumtwi is highly susceptible to climatic and related environmental changes. The temperature dependent magnetic susceptibility k(T) reflects magnetic-mineralogical changes that may indicate oscillating climatic and diagenetic effects and dust input. However, this proxy has not been quantitatively investigated in the sedimentary context of Lake Bosumtwi by multivariate statistics. Here we test an integrative approach that includes k(T), the room temperature magnetic susceptibility, its frequency dependency and gamma-ray logs into Principal Component Analyses (PCA) and Linear Discriminant Analyses (LDA). We use the differences in the operating algorithms of both analyses to disentangle the main governing factors of all proxies used with a special focus on k(T). This approach will increase our understanding of all parameters and their interdependencies. Most importantly, the nature of PCA and LDA allows for addressing anti-correlated impacts (PCA) that can be further related to changes in the depositional environment of Lake Bosumtwi by constraints provided by LDA. Through this approach, we can assess the k(T) as a proxy in the depositional context of Lake Bosumtwi that includes varying environmental conditions.

Session 4 – Anthropogenic Activity Recorded in Geoarchives

Holocene human-environmental interactions and seismic activity in a Late Bronze to Early Iron Age settlement center in the southeastern Caucasus

von Suchodoletz, Hans[1*]; Kirkitadze, Giorgi[2]; Koff, Tiiu[3]; Fischer, Markus L.[4,1]; Poch, Rosa M.[5]; Khosravichenar, Azra[1]; Schneider, Birgit[1]; Glaser, Bruno[6]; Lindauer, Susanne[7]; Navrozashvili, Levan[2]; Lobjanidze, Mikheil[2]; Akhalaia, Mate[2]; Losaberidze, Levan[8] & Elashvili, Mikheil[2]

[1] Universität Leipzig, Institut für Geographie, Johannisallee 19a, 04103 Leipzig
[2] Ilia State University, School of Natural Sciences and Engineering, Cholokashvili 3/5, GE - 0162 Tbilisi, Georgia
[3] Tallinn University, Institute of Ecology, Uus-Sadama 5, EE - 10120, Tallinn, Estoniay
[4] Universität Tübingen, Fachbereich Geowissenschaften, Hölderlinstr. 12, 72074 Tübingen
[5] Universitat de Lleida, Departament de Medi Ambient i Ciències del Sòl, Av. Alcalde Rovira Roure 191, E - 25198 Lleida, Spain
[6] Martin-Luther-Universität Halle-Wittenberg, Institut für Agrar- und Ernährungswissenschaften, Bodenbiogeochemie, von-Senckendorff-Platz 3, 06120 Halle/Saale
[7] Curt-Engelhorn-Zentrum Archaeometrie gGmbH, C4, 8, 68159 Mannheim
[8] Society of Young Archeologists of Georgia, Kipiani 4, GE - 0119 Tbilisi, Georgia
* Corresponding author: hans.von.suchodoletz@uni-leipzig.de

Long-term human-environmental interactions in naturally fragile drylands are an actual topic of geomorphological and geoarchaeological research. Furthermore, many prehistoric societies in drylands were

also affected by seismic activity. The semi-arid Shiraki Plain in the tectonically active southeastern Caucasus is currently covered by steppes and largely devoid of settlements. However, numerous Late Bronze to Early Iron Age city-type fortified settlements suggest early state formation between ca. 3.2 – 2.5 ka that abruptly ended after that time. A paleolake was suggested for the lowest plain, and nearby pollen records suggest forest clearcutting of the upper altitudes under a more humid climate during the Late Bronze/Early Iron Ages. Furthermore, also an impact of earthquakes on regional Early Iron Age settlements was suggested. However, regional paleoenvironmental changes and paleoseismicity were not systematically studied so far. We combined geomorphological, sedimentological, chronological, paleoecological and hydrological modelling data to reconstruct regional Holocene paleoenvironmental changes in the Shiraki Plain, and identify possible natural and anthropogenic causes as well as possible seismic events during the Late Bronze/Early Iron Ages. Our results show a balanced to negative Early to Mid-Holocene water balance probably caused by forested upper slopes. Hence, no lake but an incipient Chernozem developed in the lowest plain. Following, Late Bronze/Early Iron Age forest clear-cutting obviously caused lake formation and the deposition of lacustrine sediments derived from intensive soil erosion. Subsequently, regional aridification obviously caused slow lake desiccation. Remains of freshwater fishes indicate that the lake potentially offered valuable ecosystem services for regional prehistoric societies even during the desiccation period. Finally, colluvial coverage of the lake sediments during the last centuries could have been linked with hydrological extremes during the Little Ice Age. Our study demonstrates that the Holocene hydrological balance of the Shiraki Plain was and is situated near a major hydrological threshold, making the landscape very sensitive to also small-scale human or natural influences with serious consequences for local societies. Furthermore, seismites in the studied sediments do not indicate an influence of earthquakes on the main and late phases of Late Bronze/Early Iron Age settlement. Altogether, our study underlines the high value of multi-disciplinary approaches to investigate long-term human-environmental interactions and paleoseismicity in drylands on millennial to centennial time scales.

Fig. 1: *The Shiraki Plain seen from southwest.*

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Die Forschungsbohrung Martinsrieth – ein neues Profil für das jüngere Mittel- und das Oberpleistozän in der Helme-Niederung bei Sangerhausen (Sachsen-Anhalt)

Wansa, Stefan[1*]; Strahl, Jaqueline[2] & Meng, Stefan[3]

[1] Landesamt für Geologie und Bergwesen Sachsen-Anhalt (LAGB), Köthener Str. 38, 06118 Halle
[2] Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg (LBGR), Postfach 100933, 03009 Cottbus
[3] Universität Greifswald, Institut für Geographie und Geologie, Friedrich-Ludwig-Jahn Str. 17A, 17489 Greifswald
* Kontakt: stefan.wansa@sachsen-anhalt.de

Das Landesamt für Geologie und Bergwesen Sachsen-Anhalt (LAGB) hat in der Helme-Niederung im südöstlichen Harzvorland die Forschungsbohrung Martinsrieth (FB-Mtr 1/2015) zwecks Untersuchung der differenzierten und vielgliedrigen quartären Schichtenfolge sowie zur Rekonstruktion von langfristigen Senkungsbewegungen infolge der Subrosion von Zechstein-Salzen im Untergrund niederbringen lassen. Nach älteren Schichtenverzeichnissen von Bohrungen aus der Umgebung des Bohrstandortes war mit einem mächtigen mittel- und oberpleistozänen Profil zu rechnen, das u. a. Holstein- und Eem-zeitliche Sedimente enthält.

In der 152 m tiefen Bohrung wurden fast 95 m mächtige klastische Sedimente, Mudden und Torf-Lagen aus dem Quartär angetroffen. Im Liegenden folgen bis ca. 120 m Teufe tertiäre Sande, Schluffe und Braunkohle und bis zur Basis überwiegend feinkörnige Sedimentite der Bernburg-Formation (Unterer Buntsandstein).

Die quartäre Schichtenfolge wird interdisziplinär untersucht. Neben der lithologischen Kernaufnahme und den begleitenden Laboranalysen wurden pollenanalytische und faunistische Untersuchungen durchgeführt. Noch nicht abgeschlossen sind die beim Leibniz-Institut für Angewandte Geophysik (LIAG) erfolgenden Lumineszenzdatierungen.

Palynostratigraphisch nachgewiesen und teilweise paläoökologisch unterlegt durch Mollusken- und Fischfaunen wurden Ablagerungen der ausgehenden Elster-Kaltzeit, der Holstein-Warmzeit, Horstwiesen-Warmzeit, Dömnitz-Warmzeit und Eem-Warmzeit sowie der ihnen jeweils nachfolgenden Stadial-Interstadial-Abfolgen der Fuhne-Kaltzeit und Wormsdorf-Kaltzeit, des Post-Dömnitz und der frühen Weichsel-Kaltzeit erfasst.

Die Holstein-Ablagerungen (74,75–77,10 m) setzen über Elster-zeitlichem Fluviatil mit einer umfassenden Schichtlücke ein. Erhalten sind, teils mit stark korrodiertem Palynomorpheninventar, die PZ 3–5 und 7 sensu ERD (1973). Insbesondere hinsichtlich der warmzeitlichen Schattholzphase (PZ 5) bestehen bezüglich der geringen *Abies*-Anteile deutliche Parallelen zur Forschungsbohrung Ummendorf im südlichen oberen Allertal (STRAHL, 2019). Die nachgewiesene Süßwassermolluskenfauna ist charakteristisch für artenreiche Fließgewässer. Ihr fehlen jedoch mit *Corbicula fluminalis*, *Theodoxus serratiliniformis* und *Viviparus diluvianus* ebenso wie der beobachteten Landschneckenfauna mit gemäßigten Gehölz- und feuchtigkeitsliebenden Arten eindeutige mittelpleistozäne Leitformen (vgl. Meng, Wansa, 2008).

Von der direkt an das Holstein anschließenden Fuhne-Kaltzeit (74,32–74,75 m) ist lediglich der Übergang in das Kaltzeit-einleitende Stadial A überliefert, gefolgt von ca. 10 m mächtigem post-Fuhne-zeitlichem Fluviatil. Über diesem schließt sich mit einer weiteren Schichtlücke die Spätphase der Horstwiesen-Warmzeit (Strahl, 2019) zwischen 64,17 und 64,71 m mit den PZ HW 4 und HW 6 an, die als altersgleich mit der Reinsdorf-Warmzeit von Schöningen (URBAN, 1995, 2007) aufgefasst wird. Nur aus der überlagernden Stadial-Interstadial-Abfolge der Wormsdorf-Kaltzeit (Strahl, 2019) zwischen 60,67 und 64,08 m liegen wenige Molluskenarten vor, die die Existenz eines Stillgewässers oder eines langsam fließenden Gewässers belegen könnten. Bei den Landschnecken fanden sich Offenlandarten, die für eine eher kontinental geprägte Umwelt sprechen.

Hochdivers ist dagegen die zwischen 60,05 und 60,55 m erfasste wärmeliebende Fischfauna, die während der Spätphase der Dömnitz-Warmzeit (60,00–60,67 m, PZ 4b-c, 4e) vorkam.

Während von 41,30 bis 60,00 m stratenweise immer wieder Molluskenreste von Süßwasserarten auftraten, die keine näheren Aussagen zur Stratigraphie oder den Umweltbedingungen zulassen, wurde zwischen 40,10 und 40,90 m ein post-Dömnitz-zeitliches, allerdings unbewaldetes Interstadial nachgewiesen. Die limnische, ein ruhiges und langsam fließendes Gewässer belegende Fauna ist relativ artenreich, enthält aber keine mittelpleistozänen Leitarten. Terrestrische Mollusken fehlen.

Ebenfalls nur in ihrer Endphase belegt ist die Eem-Warmzeit mit den PZ 8–9 sensu ERD (1973) (9,90–10,60 m), überlagert durch Bildungen des Unter-Weichsel-kaltzeitlichen Herning-Stadials (8,90–9,90 m) mit teils viel aufgearbeitetem Eem-zeitlichen Material. Umlagerungsfrei sind hingegen das Brörup-Interstadial (8,10–8,90 m) und das darauffolgende Rederstall-Stadial (6,90–8,10 m), das durch Weichsel-zeitliches Fluviatil gekappt wird. Faunenuntersuchungen liegen für diesen Abschnitt nicht vor.

Literatur

Erd, K., 1973. Pollenanalytische Gliederung des Pleistozäns der Deutschen Demokratischen Republik. Zeitschrift geologische Wissenschaften 1, 1087–1103.

Meng, S., Wansa, S., 2008. Sedimente und Prozesse am Außenrand der Saale-Vereisung südwestlich von Halle (Saale). Zeitschrift der deutschen Gesellschaft für Geowissenschaften 159 (2), 205–220.

Strahl, J. 2019. Ergebnisse palynologischer Untersuchungen an der Forschungsbohrung Ummendorf 1/2012 und Vergleich mit anderen pollenstratigraphischen Untersuchungen im oberen Allertal. Mitteilungen zu Geologie und Bergwesen von Sachsen-Anhalt 20, 41–92.

Urban, B., 1995. Palynological evidence of younger Middle Pleistocene Interglacials (Holsteinian, Reinsdorf and Schöningen) in the Schöningen open cast lignite mine (eastern Lower Saxony, Germany). Mededelingen Rijks Geologische Dienst 52, 175–185.

Urban, B., 2007. Interglacial pollen records from Schöningen, north Germany. Sirocko, F., Claussen, M., Sanches-Goni, M. F., Litt, T. (eds.). The climate of past interglacials. Developments in Quaternary Science 7, 417–444.

Session 6 – Regionale Quartärgeologie / Regional Quaternary geology

Die Sedimentabfolgen im Oberrheingraben: Litho- und Biostratigraphie in einer tektonisch aktiven Umgebung

Wielandt-Schuster, Ulrike[1*]; Stark, Lena[1] & Hahne, Jürgen[2]

[1] Regierungspräsidium Freiburg Abt. 9 - Landesamt für Geologie, Rohstoffe und Bergbau, Freiburg, Germany
[2] Dassel, Germany
* Kontakt: ulrike.wielandt-schuster@rpf.bwl.de

Der dicht besiedelte Oberrheingraben war schon seit den Anfängen der technischen Erkundung und Nutzung natürlicher Resourcen ein intensiv bewirtschafteter Raum. Die Gliederung in Geologische Einheiten wurde dabei lange Zeit durch die Erdölprospektion vorangetrieben, deren Fokus auf der sehr mächtigen tertiären Abfolge lag, die im wesentlichen biostratigraphisch gegliedert war. Die klastischen Lockergesteine des Plio- und Pleistozän waren dagegen hydrogeologisch interessant, für deren Beschreibung wurde bis in die frühen 2000er Jahre ein korngrößenbasiertes Schema benutzt, das auf Bartz (1959) zurückgeht.

Erst mit dem Heidelberg-Projekt (Ellwanger et al. 2008) verlagerte sich der Fokus in der Kernbeschreibung der klastischen Lockersedimente auf Sedimentologie, Ablagerungsdynamik und Lithofazies und der Identifizierung einzelner Ablagerungszyklen. Unterstützt durch palynologische und sedimentpetrographische Daten konnte ein neues, lithostratigrapisches Gliederungsschema für den ganzen ORG entwickelt werden, das seit 2011 erfolgreich genutzt wird (LGRB Symbolschlüssel 2011).

Alle für den Oberrheingraben aufgestellten Lockergesteinseinheiten sind lithostratigraphisch definiert (siehe Litholex). Dank der Berücksichtigung der überregionalen Ablagerungsdynamik bei der Definition der Einheiten ist häufig die Korrelation von Bohrungen auch über größere Entfernungen hinweg möglich und bestätigt den Einfluss junger tektonischer Bewegungen auf die Sedimentation. Auch die quartären Einheiten zeigen markante Vertikalversätze, Aufschiebungen sowie den Ausfall ganzer Einheiten durch Hebung und Erosion. Es zeigt sich, dass das tektonische Regime das Sedimengtationsgeschehen besonders im nördlichen Grabenbereich beinflusst hat und die Kallstadt-Schwetzingen-Störungszone unterschiedliche Ablagerungsräume voneinander trennt.

Im Laufe der vergangenen 10 Jahre hat sich auch die palynostratigraphische Datenlage wesentlich erweitert. So konnte im Raum Rastatt die Existenz eines großflächigen Sumpfzypressenwalds in pliozänen Feinklastika der Iffezheim-Fm. nachgewiesen werden. Andernorts erbrachten mehrere Bohrungen eine Flora, die nach Vergleich mit Daten aus Norddeutschland in das Cormer 1 gestellt wird.

Der Vortrag dokumentiert in einigen Beispielen neu hinzugekommene Erkenntnisse aus den letzten 10 Jahren, mit deren Hilfe das Gliederungsschema fortgeschrieben werden kann (Fig.1).

Literatur

Bartz, J., 1959. Zur Gliederung des Pleistozäns im Oberrheingebiet. Zeitschrift der Deutschen Geologischen Gesellschaft 111, 653–661.

Ellwanger, D., Gabriel, G., Simon, T., Wielandt-Schuster U., Greiling, R., Hagedorn, E.-M., Hahne, J. & Heinz, J., 2008. Long sequence of Quaternary Rocks in the Heidelberg Basin Depocentre. E&G Quaternary Science Journal 57, 316–337.

LGRB, 2011 Symbolschlüssel Geologie Baden-Württemberg - Verzeichnis Geologischer Einheiten (Ausgabe 2011), Hrsg. Regierungspräsidium Freiburg, Landesamt für Geologie, Rohstoffe und Bergbau. (https://www.lgrb-bw.de)

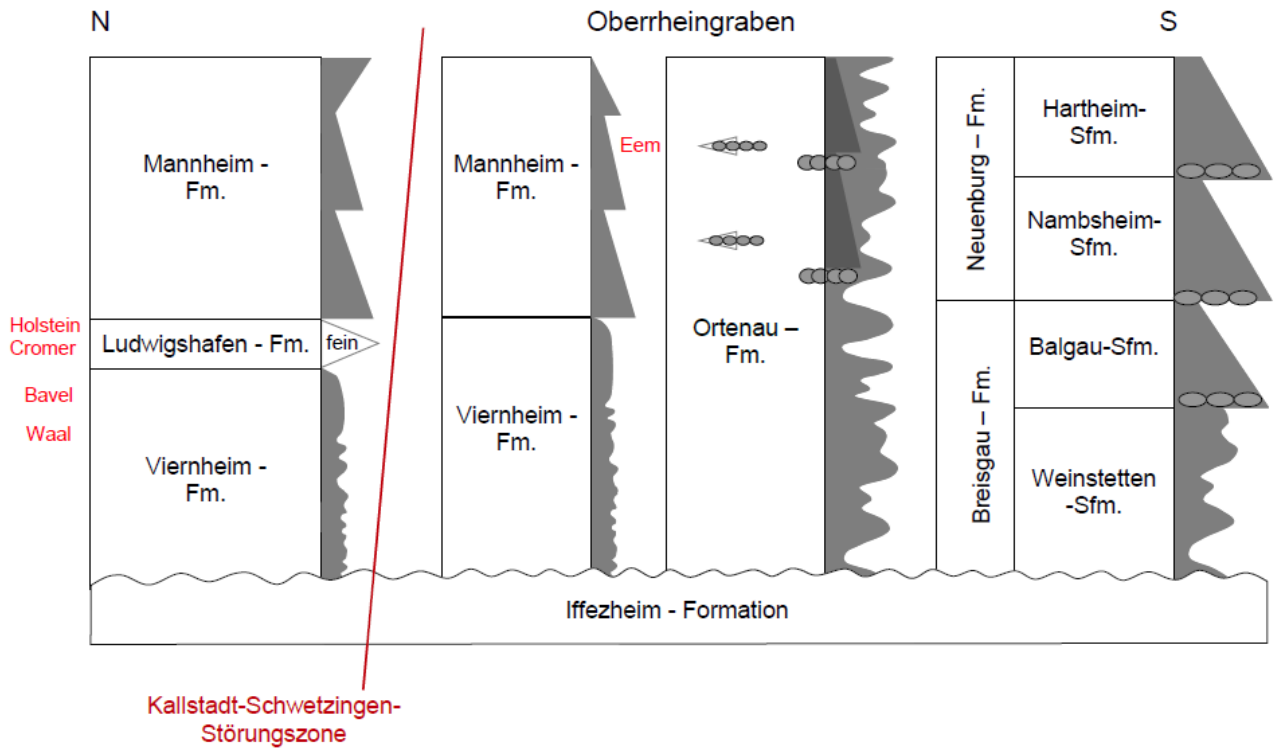

Fig. 1: *Aktualisierte lithostratigraphische Gliederung für die plio- und pleistozänen Sedimenteinheiten im Oberrheingraben Baden-Württmbergs*.

Session 5 – Earth Surface Processes and Environmental Change

Potential for palaeoclimatic interpretation of periglacial landforms applying Schmidt-hammer exposure-age dating (SHD), examples from Norway and New Zealand

Winkler, Stefan*

University of Würzburg, Department of Geography and Geology, Würzburg, Germany
* Corresponding author: stefan.winkler@uni-wuerzburg.de

The potential of periglacial landforms in the context of palaeoclimatic interpretation bases on their connection to climate-driven permafrost conditions with both initial formation and continuing activity. Their utilisation for this purpose involves, however, specific challenges. Many periglacial landforms represent transitional processes of certain duration rather than clearly defined single events. There is also a high risk of postdepositional disturbance by frost-related processes. These characteristics causes problems for any application of numerical dating techniques. Although *per se* suited for boulder-dominated periglacial landforms such as patterned ground or rock glaciers, cosmogenic radionuclide dating (CRN) faces the problem that large sample sizes would be required to achieve reliable ages.

The calibrated-age dating technique of Schmidt-hammer exposure-age dating (SHD) has recently been successfully utilised for obtaining age constraints of periglacial landforms. If independent (numerical) age data allows to establish local or regional SHD age-calibration curves, SHD offers the fundamental advantage of obtaining large sample sizes (hundreds or even thousands of boulders) to overcome the abovementioned limitations of CRN. This advantage is crucial for dating diachronous landforms or landforms potentially affected by postdepositional disturbance. To highlight the potential of SHD the results of investigations on (a) patterned ground and related features on Juvflye in Jotunheimen (South Norway) and (b) rock glaciers in the Ben Ohau Range (Southern Alps/New Zealand) will be presented.

By applying a reliable local SHD age-calibration curve for Juvflye, all patterned ground features seem to cease activity and become stabilised/inactive prior or around the onset of the Holocene Thermal Maximum (HTM). Recent mophodynamic activity is restricted to minor frost-related processes and include micro-scale frost sorting features and solifluction terracettes. This stabilisation of patterned ground features at the onset of HTM took place despite at least middle and higher altitudes of Juvflye have been underlain by permafrost during the entire Holocene (and still are). Their stabilisation seems, therefore, independent of fluctuations of the lower limit of permafrost. SHD stabilisation ages challenge, therefore, the general application of large patterned ground features as palaeoclimatic indicators for permafrost. The formation of patterned ground and related large-sized periglacial landforms on Juvflye could well have be restricted to a limited time period immediately following deglaciation during Early Holocene. From a morphodynamic point of view the occurrence of permafrost per se cannot be the sole factor for efficient formation of patterned ground and factors such as soil moisture, active layer thickness, or suitable substrate etc. need to be taken into account.

A local SHD calibration-curve for the Ben Ohau Range yielded relatively old ages for rock glaciers previously considered to have been formed during Mid- or Late Holocene. Because these rock glaciers partly developed in cirques occupied by Late Glacier glaciers at least until after the Antarctic Cold Reversal (ACR), these glaciers must have disappeared much earlier than anticipated, possibly as early as around the onset of the Holocene. More research is necessary, but the potential of SHD is underlined by these studies.

Reference

Matthews, J.A., Winkler, S., 2012. Schmidt-hammer exposure-age dating: a review of principles and practice. Earth Science Reviews, published online, https://doi.org/10.1016/j.earscirev.2022.104038

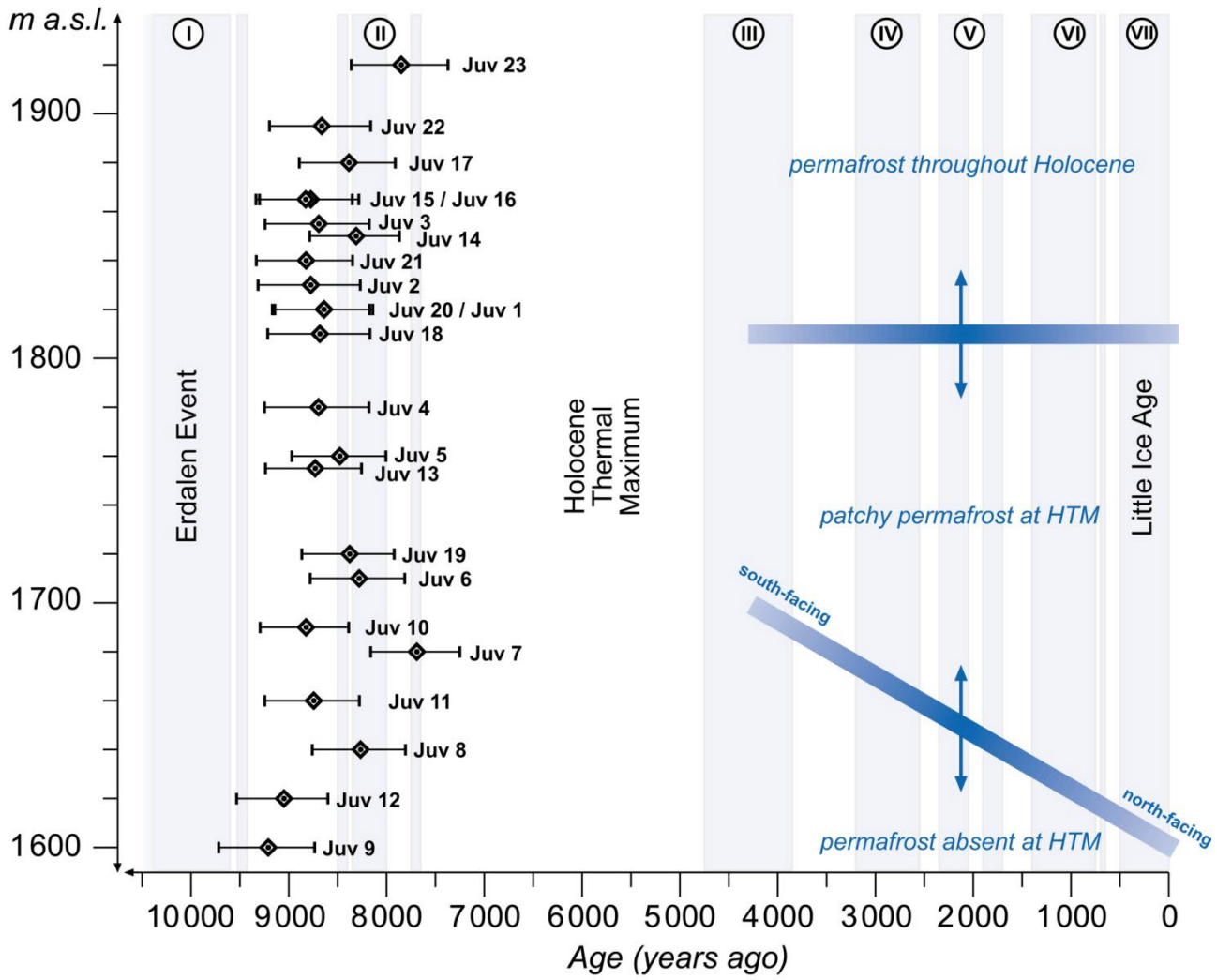

Fig. 1: *SHD ages (± 95% confidence intervals) for stone stripes on Juvflye, Jotunheimen, South Norway (for details and further explanation, see Matthews & Winkler 2022).*

Session 3 – Synchronisation and Dating of Proxy Records

Connecting loess archives in the Western and Eastern Mediterranean

Wolf, Daniel[1*]; Kolb, Thomas[2, 3]; Lomax, Johanna[2]; Zöller, Ludwig[3]; Fuchs, Markus[2] & Faust, Dominik[1]

[1] Technische Universität Dresden, Institute of Geography, Dresden, Germany
[2] Justus Liebig Universiy Giessen, Institute of Geography, Giessen, Germany
[3] University of Bayreuth, Chair of Geomorphology, Bayreuth, Germany
* Corresponding author: daniel_wolf@tu-dresden.de

Within the broad field of loess research, studies on Mediterranean loess sections are heavily under-represented considering their great value for reconstructing palaeoenvironmental conditions during the Quaternary period. Taking into account the displacement of atmospheric circulation patterns, especially during stadial phases, the Mediterranean realm has often fallen into the transition zone between polar and subtropical air masses. Hence, these areas are particularly suitable for investigating the influence of different atmospheric systems, e. g. the westerlies, on past landscapes and environments.

Here we present the main results of several research projects dealing with loess dynamics in the Western Mediterranean (central Spain) as well as the outermost Eastern Mediterranean (northeastern Armenia, Southern Caucasus). Apart from the most important stratigraphic and geochronologic patterns, we demonstrate selected proxy information that enable a detailed reconstruction of palaeoenvironments linked to loess formation as well as pedogenesis. The integration of regional terrestrial archive information, e. g. on glacier advances or vegetation dynamics, further help to improve the picture of the environmental framework for the buildup of Mediterranean loess sequences.

Finally, the attempt is made to connect both loess archives and also include marine archive information for providing a very general idea of last glacial climate-related environmental changes over the Mediterranean area.

References

Lomax, J., Wolf, D., Meliksetian, K., Wolpert, T., Sahakyan, L., Hovakimyan, H., Faust, D., Fuchs, M., 2022. Testing post-IR-IRSL dating on Armenian loess-palaeosol sections against independent age control. Quaternary Geochronology 69, 101265.

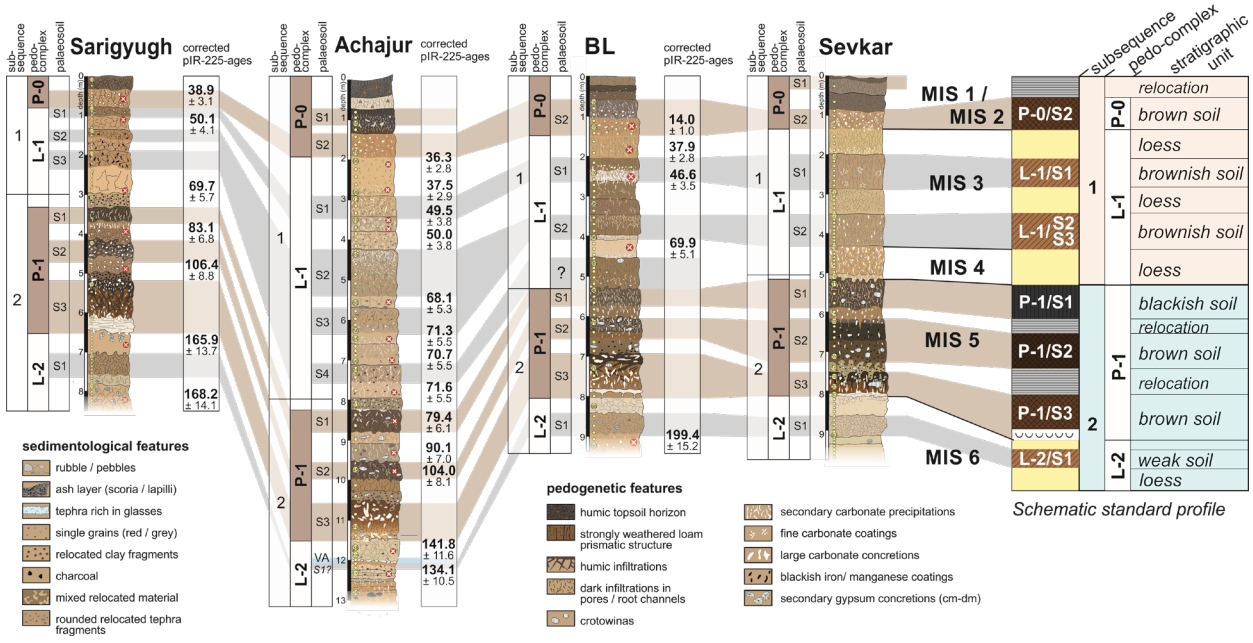

Fig. 1: *Stratigraphic correlation and chronology of different loess sections in NE-Armenia for the last glacial-interglacial cycle including a simplified standard profile (after Lomax et al. 2022).*

Session 5 – Earth Surface Processes and Environmental Change

First results of regional-scale assessments of Holocene lake drainage ages in Arctic permafrost regions

Wolter, Juliane[1,2*]; Bergstedt, Helena[3]; Farquharson, Louise[4]; Jones, Benjamin[5]; Mikhail Kanevskyi[5]; Roy-Leveillee, Pascale[6]; Veremeeva, Alexandra[7] & Grosse, Guido[2]

[1] University of Potsdam, Institute od Biochemistry and Biology, Potsdam, Germany
[2] Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Section Permafrost Research, Potsdam, Germany
[3] bgeos, Korneuburg, Austria
[4] Geophysical Institute Permafrost Laboratory University of Alaska Fairbanks
[5] Institute of Northern Engineering, University of Alaska Fairbanks
[6] Department of Geography, Université Laval
[7] Laboratory of Soil Cryology, Inst. of Physicochemical and Biological Problems in Soil Science, Russian Academy of Sciences
* Corresponding author: juliane.wolter.1@uni-potsdam.de

Lakes and drained lake basins are abundant landforms in Arctic lowlands with ice-rich permafrost. Many of these lakes formed by thermokarst (thaw of ice-rich permafrost and subsequent subsidence) or when formed by other processes were reshaped by thermokarst dynamics. Growth and gradual expansion of lakes frequently leads in partial of full drainage of the mostly shallow lakes, resulting in complex landscape-scale mosaics of lakes and multiple generations of drained basins across Arctic lowlands. These patterns and dynamics directly affect hydrology (water storage, seasonal runoff), ecology (habitat for fish and waterfowl, aquatic connectivity, vegetation succession), and biogeochemical cycling (carbon storage and mobilization). While lakes variably act as carbon source or sink depending on their age and specific environmental setting, drained lake basins mostly contain wetlands that act as carbon sinks, especially when wetlands have been developing for longer time periods (Jones et al., 2022). Meaningful estimations of how thawing and mobilized permafrost carbon contribute to the atmospheric carbon greenhouse gas content must therefore not only include information on the spatio-temporal distribution of drained lake basins but also their age. While for Arctic lakes a solid picture of age distribution emerged from the abundant studies of lake histories and more than 1200 radiocarbon-dated lake sediment chronologies (Brosius et al., 2021) The region-wide quantification drained lake basins formed throughout the Holocene requires sampling of drained lake basins and radiocarbon-dating of terrestrial peat that formed directly above lacustrine sediments for extensive lowland regions from northern Siberia, across Alaska to the Canadian Arctic, following the distribution of ice-rich permafrost. In this study, we present the first database of lake drainage ages covering that entire area. We present >100 new drainage ages and additional dates synthesized from the scientific literature. We assessed the quality of the dates and the stratigraphic, sedimentologic or biogeochemical identification of drainage events for each basin. We started to investigate and characterize spatial and temporal patterns in the geochronological data and will present first preliminary findings. Our drainage age database will be further used to quantify carbon dynamics of drained lake basins in Arctic lowlands. For the first time, the regional spatial scale and the Holocene time scale will ensure representative information for this highly relevant and abundant permafrost landform.

References

Brosius et al., 2021. Spatiotemporal patterns of northern lake formation since the Last Glacial Maximum. Quaternary Science Reviews 253, 106773. Doi: 10.1016/j.quascirev.2020.106773

Jones et al., 2022. Lake and drained lake basin systems in lowland permafrost regions. Nature Reviews Earth and Environment 3, 85–98. Doi: 10.1038/s43017-021-00238-9.

Session 1 – Climate variability and warmer climates

Size matters: geographical variability of valve size of *Cyprideis torosa* and its taxonomic and ecologic implications

Wrozyna, Claudia[1*]; Mischke, Steffen[2]; Höhle, Marlene[3]; Gross, Martin[4] & Piller, Werner E.[5]

[1] University of Greifswald, Institute of Geography and Geology, Greifswald, Germany
[2] Institute of Earth Sciences, University of Iceland, Reykjavík, Iceland
[3] University of Leipzig, Institute of Geophysics and Geology, Leipzig, Germany
[4] Universalmuseum Joanneum, Department for Geology & Palaeontology, Graz, Austria
[5] University of Graz, Institute of Earth Sciences, NAWI Graz Geocenter, Graz, Austria
* Corresponding author: claudia.wrozyna@uni-greifswald.de

Quaternary palaeoclimatic reconstructions from biological proxies (remains of organisms) strongly depend on the biological knowledge and understanding of the variables to which the organisms are sensitive and how they respond to changes in these variables. Coupled autecological-actualistic approaches are usually used to identify species-environmental relationships. However, these approaches often rely on geographically restricted areas covering only a part of the geographical range of the species resulting in uncertainties in palaeoenvironmental reconstructions.

With their ubiquitous distribution in almost all types of aquatic habitats, ostracods became popular proxies for palaeoclimatic and -ecological research. Beside changes in species assemblage composition, ostracods are also known to reflect environmental changes in their valve morphology (i.e., size, ornamentation, shape). This study investigates large-scale (31–51° latitude, and 12–96° longitude) variability of valve size of Holocene and Recent *Cyprideis torosa* (Fig. 1.), a species well known for its high tolerance against salinity and typically occurring in marginal marine areas. Our results show that *C. torosa* provides two large-scale patterns in body size with (1) differentiation of distinct size classes (i.e., morphotypes) at ~42°N and, (2) a continuous increase in valve size with latitude, which corresponds to the macroecological pattern referred as Bergmann trend. While latitude explains the overall size variability of *C. torosa* sensu lato (i.e., undifferentiated for morphotypes), salinity-size correlations are restricted to the morphotype scale. Existing explanations of Bergmann trends (e.g., latitude-temperature relationships) insufficiently resolve the observed size cline of *C. torosa*. Since these models apply for intraspecific size patterns, the observed size-latitude relationship of *C. torosa* may result from interspecific divergence (i.e., size-ordered spatial sorting) while environmental influence is of minor importance. Our results highlight the importance of considering phylogenetic relationships of ostracods before attempting to relate environmental variables to morphological traits such as size.

References

Wouters, K. 2017. On the modern distribution of the euryhaline species *Cyprideis torosa* (Jones, 1850) (Crustacea, Ostracoda). J Micropalaeontol 36, 21–30.

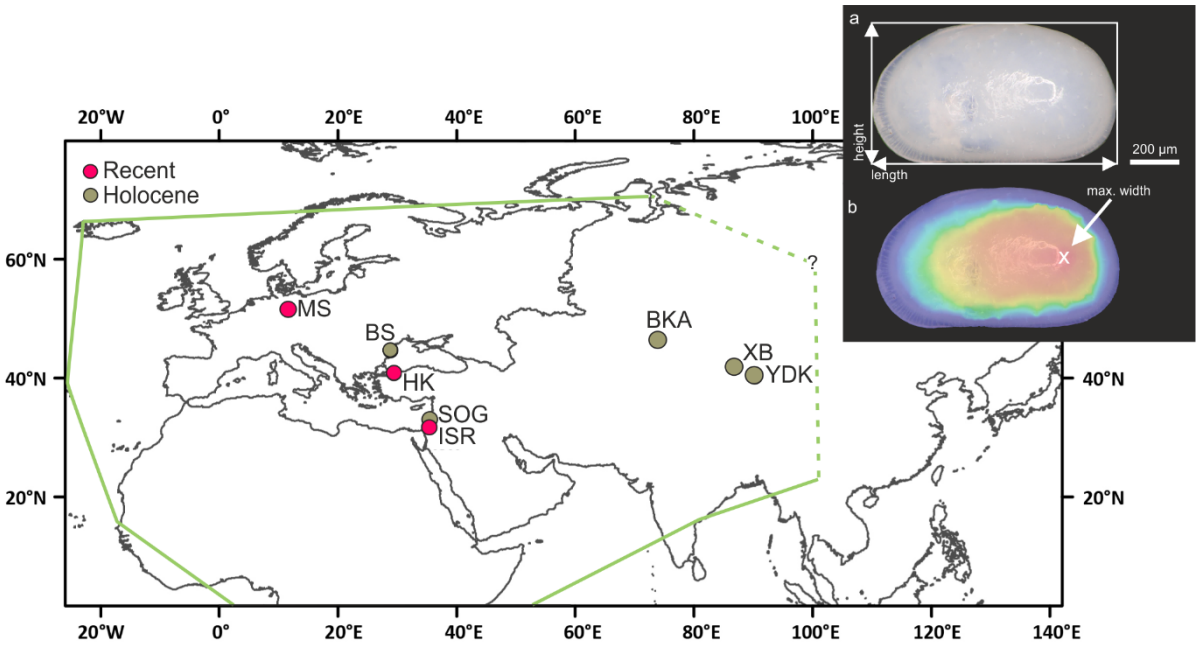

Fig. 1: *Map of the Eurasian realm, showing the localities (YDK = Tarim Basin, China; XB = Lake Bosten, China; BKA = Lake Balkhash, Kazakhstan; ISR = Dead Sea, Israel; SOG = Sea of Galilee, Israel; BS = Danube Delta, Romania; HK = Hersek lagoon, Turkey; MS = Mansfeld Lakes, Germany) of investigated Cyprideis valves and the geographical range of C. torosa according to Wouters (2017) (green line). Inset displays measured size traits on Cyprideis valves. Length and height were measured as maximum extension of the valve outline (a). Valve width was obtained as maximum height of focus stacked photographs (b). Displayed are female left valves, measurements were, however, identical for male left and right valves.*

Session 4 – Anthropogenic Activity Recorded in Geoarchives

The Lower Havel River Region (Brandenburg, Germany): A 230-Year-Long Historical Map Record Indicates a Decrease in Surface Water Areas and Groundwater Levels

Zielhofer, Christoph[1*]; Schmidt, Johannes[1]; Reiche, Niklas[1]; Tautenhahn, Marie[1]; Ballasus, Helen[1]; Burkart, Michael[2]; Linstädter, Anja[2,3]; Dietze, Elisabeth[4]; Kaiser, Knut[5] & Mehler, Natascha[6,7]

[1] Leipzig University, Chair of Physical Geography, Leipzig, Germany
[2] University of Potsdam, Botanical Garden, Potsdam, Germany
[3] University of Potsdam, Biodiversity Research/Systematic Botany, Potsdam, Germany
[4] Alfred Wegener Institute, Geosciences, Polar Terrestrial Environmental Systems, Potsdam, Germany
[5] GFZ German Research Centre for Geosciences, Staff Scientific Executive Board, Potsdam, Germany
[6] Tübingen University, Institute of Prehistoric and Medieval Archaeology, Tübingen, Germany
[7] University of the Highlands and Islands, Institute for Northern Studies, Kirkwall, Orkney, UK
* Corresponding author: zielhofer@uni-leipzig.de

Instrumental data show that the groundwater and lake levels in Northeast Germany have decreased over the past decades, and this process has accelerated over the past few years. In addition to global warming, the direct influence of humans on the local water balance is suspected to be the cause. Since the instrumental data usually go back only a few decades, little is known about the multidecadal to centennial-scale trend, which also takes long-term climate variation and the longterm influence by humans on the water balance into account. This study aims to quantitatively reconstruct the surface water areas in the Lower Havel Inner Delta and of adjacent Lake Gülpe in Brandenburg. The analysis includes the calculation of surface water areas from historical and modern maps from 1797 to 2020. The major finding is that surface water areas have decreased by approximately 30% since the pre-industrial period, with the decline being continuous. Our data show that the comprehensive measures in Lower Havel hydro-engineering correspond with groundwater lowering that started before recent global warming. Further, large-scale melioration measures with increasing water demands in the upstream wetlands beginning from the 1960s to the 1980s may have amplified the decline in downstream surface water areas.

References

Zielhofer, C., Schmidt, J., Reiche, N., Tautenhahn, M., Ballasus, H., Burkart, M., Linstädter, A., Dietze, E., Kaiser, K., Mehler, N., 2022. The Lower Havel River Region (Brandenburg, Germany): A 230-Year-Long Historical Map Record Indicates a Decrease in Surface Water Areas and Groundwater Levels. Water 14, 480.

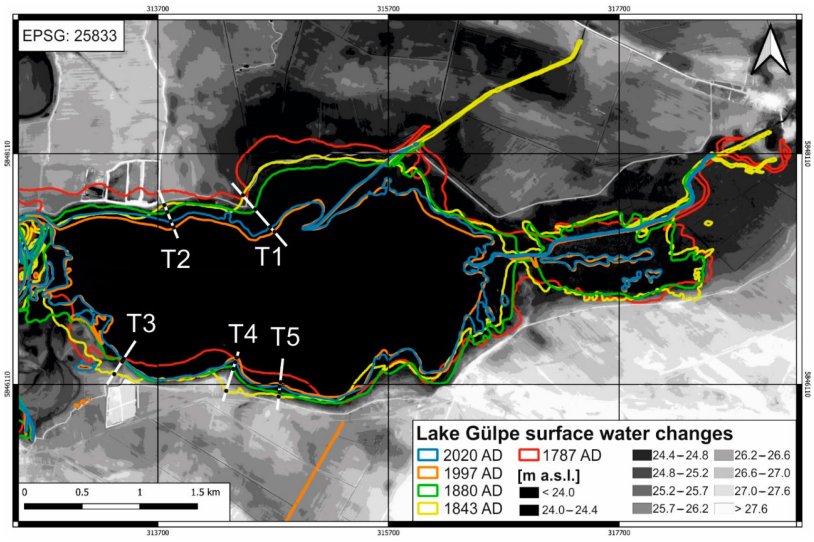

Fig. 1: *Changes in Lake Gülpe surface water areas as a reconstruction from historical and modern maps. The transects T1–T5 indicate the coupling of shorelines from map records with LiDAR-based DEM data for the reconstruction of lake level changes (Zielhofer et al. 2022).*

List of participants – DEUQUA 2022 "Connecting Geoarchives"

Institutions and abbreviations

AWI *= Alfred-Wegener-Institut, Helmholtz-Zentrum für Polar- und Meeresforschung*
Beta Analytic, Inc
BGR *= Bundesanstalt für Geowissenschaften und Rohstoffe*
BOKU = *Universität für Bodenkultur Wien (University of Natural Resources and Life Sciences)*
BTU *= Brandenburgische Technische Universität Cottbus-Senftenberg (BTU), Geopedologie und Landschaftsentwicklung*
CAU Kiel *= Christian-Albrechts-Universität Kiel,* ***ÖSF*** *Institut für Ökosystemforschung*
DAI *= Deutsches Archäologisches Institut Berlin*
ETH *= Eidgenössische Technische Hochschule Zürich, Schweiz*
FAU *= Friedrich-Alexander-Universität Erlangen-Nürnberg, Institut für Geographie*
FU Berlin *= Freie Universität Berlin, Institut für Geographische Wissenschaften*
GAU *= Georg-August-Universität Göttingen, Geographisches Institut*
Geologische Bundesanstalt Wien
GEOMAR *= Helmholtz-Zentrum für Ozeanforschung Kiel*
GFZ *= Helmholtz-Zentrum Potsdam – Deutsches GeoForschungsZentrum, Potsdam;* ***Section 3.7*** *Geomikrobiologie;* ***Sektion 4.3*** *Klimadynamik und Landschaftsentwicklung;* ***Sektion 4.6*** *Geomorphologie;* ***Sektion 4.7*** *Erdoberflächenprozessmodellierung;* ***Sektion 5.1*** *Bibliothek und Informationsdienste*
HLNUG *= Hessisches Landesamt für Naturschutz, Umwelt und Geologie*
HNE *= Hochschule für nachhaltige Entwicklung Eberswalde*
HZDR *= Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz-Institut Freiberg für Ressourcentechnologie*
HUJI *= Hebrew University of Jerusalem, Israel*
IGSO PAS *= Polish Academy of Sciences, Institute of Geography and Spatial Organization, Warsaw and Toruń, Poland*
IOW *= Leibniz-Institut für Ostseeforschung Warnemünde, Marine Geologie*
JGU Mainz *= Johannes Gutenberg-Universität Mainz, Geographisches Institut*
JLU Gießen *= Justus-Liebig-Universität Gießen, Institut für Geographie*
KOBO *= Kompetenzzentrum Boden, Zollikofen, Schweiz*
LAGB *= Landesamt für Geologie und Bergwesen Sachsen-Anhalt*
LBEG Niedersachsen *= Landesamt für Bergbau, Energie und Geologie Niedersachsen*
LBGR Brandenburg *= Landesamt für Bergbau, Geologie und Rohstoffe Brandenburg*
LGB-RLP *= Landesamt für Geologie und Bergbau Rheinland-Pfalz*
LIAG *= Leibniz-Institut für Angewandte Geophysik Hannover*
LLUR *= Landesamt für Landwirtschaft, Umwelt und ländliche Räume Schleswig-Holstein*
MPI SHH = *Max-Planck-Institut für Geoanthropologie, Abteilung für Archäologie, Jena*
NATMUS *= The National Museum of Denmark, Environmental Archaeology and Materials Science*
PIK *= Potsdam-Institut für Klimafolgenforschung*
RPF-LGRB *= Regierungspräsidium Freiburg, Landesamt für Geologie, Rohstoffe und Bergbau Baden-Württemberg*
Senckenberg Forschungsstation für Quartärpaläontologie
Swansea University*, Geography Department*
TU Berlin *=Technische Universität Berlin, Institut für Angewandte Geowissenschaften*
TU Braunschweig*, Institut für Geosysteme und Bioindikation*
TU Dresden *= Technische Universität Dresden, Institut für Geographie*
TUM *= Technische Universität München, Professur für Hangbewegungen*
UGA *= Université Grenoble Alpes, Institut des Géosciences de l’Environnement*
UNAM *=Universidad Nacional Autónoma de México, Instituto de Geofísica*
Universität Bremen, *Institut für Geographie*
Universität Freiburg, *Institut für Geo- und Umweltnaturwissenschaften*
Universität Göttingen, *Geographisches Institut*
Universität Greifswald, *Institut für Geographie und Geologie*
Universität Heidelberg, *Institut für Geowissenschaften*
Universität Jena*, Institut für Geographie*
Universität Köln, *Geographisches Institut*

***Universität Leipzig Geog** = Institut für Geographie; **Geol** = Institut für Geophysik und Geologie*
***Universität Potsdam,** Institut für Biochemie und Biologie*
***Universität Salzburg,** Fachbereich Umwelt und Biodiversität*
***Universität Tübingen**, Geographisches Institut*
***Universität Würzburg**, Institut für Geographie und Geologie*
***University of Cambridge**, Scott Polar Research Institute, U.K.*
***University of Sheffield,** Department of Geography, U.K.*
***University of Silesia**, Institute for Ecology of Industrial Areas, Katowice, Polen*

	Name, Surname	**Institution**	**Email**
Dr.	Ankit, Ankit	GAU Göttingen	ph17018@iisermohali.ac.in
Dr.	Asch, Kristine	BGR	Keca_Asch@yahoo.de
	Avendaño, Diana	UNAM	da.avendano.v@ciencias.unam.mx
	Baisheva, Izabella	AWI Potsdam	izabella.baisheva@awi.de
Prof.	Bauch, Henning	AWI c/o GEOMAR	hbauch@geomar.de
	Bauer, Simeon	Oskar-von-Miller-Gymna-sium München	simeurope@gmx.de
Prof.	Bebermeier, Wiebke	FU Berlin	wiebke.bebermeier@fu-berlin.de
Dr.	Berndt, Christopher	Universität Greifswald	christopher.berndt@uni-greifswald.de
	Birlo, Stella	Universität Bremen	sbirlo@uni-bremen.de
Dr.	Biskaborn, Boris	AWI Potsdam	boris.biskaborn@awi.de
Dr.	Blanchet, Cécile	GFZ, Sektion 4.3	blanchet@gfz-potsdam.de
Prof.	Błaszkiewicz, Mirosław	IGSO PAS Warschau	mirek@geopan.torun.pl
Dr.	Bolland, Alexander	Universität Leipzig Geog	alexander.bolland@uni-leipzig.de
Prof.	Böse, Margot	FU Berlin	m.boese@fu-berlin.de
	Brademann, Brian	GFZ, Sektion 4.3	brademan@gfz-potsdam.de
	Brandtner, Wolfgang	privat	wolfgang.brandtner@gmx.de
Prof.	Brauer, Achim	GFZ, Sektion 4.3	brau@gfz-potsdam.de
Dr.	Breuer, Sonja	BGR	sonja.breuer@bgr.de
	Bruns, Ines	LBEG Niedersachsen	ines.bruns@lbeg.niedersachsen.de
	Bussert, Robert	TU Berlin	r.bussert@tu-berlin.de
Dr.	Capron, Emilie	UGA - IGA	emilie.capron@univ-grenoble-alpes.fr
Dr.	Czymzik, Markus	IOW	markus.czymzik@io-warnemuende.de
Prof.	Davies, Siwan	Swansea University	siwan.davies@swansea.ac.uk
Prof.	Diekmann, Bernhard	AWI Potsdam	bernhard.diekmann@awi.de
	Diemont, Christiaan	University of Sheffield	crdiemont1@sheffield.ac.uk
Prof.	Dietze, Elisabeth	GAU Göttingen	elisabeth.dietze@geo.uni-goettingen.de
Dr.	Dietze, Michael	GAU Göttingen	michael.dietze@uni-goettingen.de
	Donke, Sebastian	LBGR Brandenburg	sebastiandonke@web.de
Dr.	Dreibrodt, Stefan	CAU Kiel, ÖSF	sdreibrodt@ecology.uni-kiel.de
Dr.	Eberle, Joachim	Universität Tübingen	joachim.eberle@uni-tuebingen.de
	Eckmeier, Eileen	CAU Kiel, ÖSF	eeckmeier@ecology.uni-kiel.de
	Ehlers, Jürgen	privat	jehlersqua@outlook.de
Dr.	Elbracht, Jörg	LBEG Niedersachsen	joerg.elbracht@lbeg.niedersachsen.de
	Firla, Gustav	BOKU	gustav.firla@boku.ac.at
	Fischer, Alexa	Universität Heidelberg	alexa.fischer@geow.uni-heidelberg.de
Dr.	Fischer, Peter	JGU Mainz	p.fischer@geo.uni-mainz.de
Dr.	Francis, Oliver	GFZ, Sektion 4.7	oliver.francis@gfz-potsdam.de
Dr.	Fuchs, Margret	HZDR	m.fuchs@hzdr.de
Prof.	Fuchs, Markus	JLU Gießen	Markus.Fuchs@geogr.uni-giessen.de

	Name, Surname	Institution	Email
	Fülling, Alexander	Universität Freiburg	alexander.fuelling@geologie.uni-freiburg.de
Dr.	Futterer, Birgit	LBGR Brandenburg	Birgit.Futterer@lbgr.brandenburg.de
Dr.	García, María Luján	Universität Bremen	garcia@uni-bremen.de
Dr.	Gegg, Lukas	Universität Freiburg	lukas.gegg@geologie.uni-freiburg.de
	Geis, Anna-Lena	JLU Gießen	Anna.L.Geis@geogr.uni-giessen.de
	Gerschke, Christine	GFZ, Sektion 4.3	gerschke@gfz-potsdam.de
Prof.	Gibbard, Philip	University of Cambridge	plg1@cam.ac.uk
	Gigon, Joséphine	Beta Analytic, Inc	advertising@betalabservices.com
	Glückler, Ramesh	AWI Potsdam	ramesh.glueckler@awi.de
	Gravier, Blaise	Universität Leipzig Geog	blaise.gravier@uni-leipzig.de
	Grimm, Bastian	JGU Mainz	bastian.eww.grimm@t-online.de
	Grimm, Lennart	AWI Potsdam	lennart.grimm@awi.de
Dr.	Grosfeld, Klaus	AWI Bremerhaven	klaus.grosfeld@awi.de
Dr.	Guillerm, Emmanuel	GFZ, Sektion 4.3	emmanuel.guillerm@outlook.fr
Prof.	Haberzettl, Torsten	Universität Greifswald	torsten.haberzettl@uni-greifswald.de
Dr.	Hajati, Mithra-Christin	LBEG Niedersachsen	Mithra-Christin.Hajati@lbeg.niedersachsen.de
	Hartmann, Tim	LBEG Niedersachsen	Tim.Hartmann@lbeg.niedersachsen.de
Dr.	Hebenstreit, Robert	FU Berlin	robert.hebenstreit@fu-berlin.de
Dr.	Heinrich, Ingo	DAI & GFZ, Sektion 4.3	heinrich@gfz-potsdam.de
Dr.	Hoelzmann, Philipp	FU Berlin	philipp.hoelzmann@fu-berlin.de
Dr.	Höfer, Dana	Senckenberg Forschungs-station für Quartärpaläontologie	dana.hoefer@senckenberg.de
	Hofmann, Felix Martin	Universität Freiburg	felix.martin.hofmann@geologie.uni-freiburg.de
	Höhle, Marlene	Universität Leipzig Geol	marlene.hoehle@uni-leipzig.de
Dr.	Hoselmann, Christian	HLNUG	Christian.Hoselmann@hlnug.hessen.de
Dr.	Ionita-Scholz, Monica	AWI Bremerhaven	Monica.Ionita@awi.de
Prof.	Ivy-Ochs, Susan	ETH Zürich	ivy@phys.ethz.ch
Dr.	Juschus, Olaf	HNE Eberswalde	olaf.juschus@hnee.de
Dr.	Juśkiewicz, Włodzimierz	IGSO PAS Torun	w.juskiewicz@geopan.torun.pl
	Kamleitner, Sarah	ETH Zürich	kamsarah@phys.ethz.ch
Dr.	Kearney, Rebecca	GFZ, Sektion 4.3	rebecca.kearney@gfz-potsdam.de
Dr.	Kehl, Martin	Universität Köln	kehlm@uni-koeln.de
	Kertscher, Cathleen	Universität Leipzig Geog	cathleen.kertscher@uni-leipzig.de
Dr.	Kirsten, Fabian	FU Berlin	fabian.kirsten@fu-berlin.de
Prof.	Kleber, Arno	TU Dresden	Arno.Kleber@tu-dresden.de
	Klinger, Aileen	JGU Mainz	aklinger@students.uni-mainz.de
Dr.	Knapp, Sibylle	TUM	sibylle.knapp@tum.de
	Kögler, Laura	JLU Gießen	Laura.Koegler@geogr.uni-giessen.de
	Köhler, Anne	Universität Leipzig Geog	anne.koehler@uni-leipzig.de
	Köppl, Matthias	GFZ, Sektion 4.3	mkoeppl@gfz-potsdam.de
Dr.	Kolb, Thomas	JLU Gießen	thomas.r.kolb@geogr.uni-giessen.de
Dr.	Koutsodendris, Andreas	Universität Heidelberg	andreas.koutsodendris@geow.uni-heidelberg.de
	Kowalski, Slawomir	LBGR Brandenburg	Slawomir.Kowalski@lbgr.brandenburg.de

	Name, Surname	Institution	Email
Dr.	Krahn, Kim Jasmin	TU Braunschweig	k.krahn@tu-braunschweig.de
	Krauß, Nikolas	Universität Greifswald	nikolas.krauss@uni-greifswald.de
Dr.	Krienke, Kay	LLUR	kay.krienke@llur.landsh.de
Dr.	Krüger, Sascha	NATMUS	sas@natmus.dk
	Labahn, Jakob	TU Dresden	jakob.labahn@tu-dresden.de
	Latzkow, Leon-Elias	GFZ, Sektion 3.4	lel@gfz-potsdam.de
Prof.	Liebner, Susanne	GFZ, Sektion 3.7	sliebner@gfz-potsdam.de
	Lindemaier, Kathrin	JGU Mainz	klindema@students.uni-mainz.de
Dr.	Lomax, Johanna	JLU Gießen	johanna.lomax@geogr.uni-giessen.de
	Lorenz, Melanie	GFZ, Sektion 5.1	mellorenz@posteo.de
Prof.	Lüthgens, Christopher	BOKU	christopher.luethgens@boku.ac.at
Dr.	Maezumi, Shira (Yoshi)	MPI SHH Jena	shira.maezumi@gmail.com
	Marburg, Carsten	TU Dresden	carsten.marburg@tu-dresden.de
	Marik, Madhurima	Universität Freiburg	madhurima.marik@geologie.uni-freiburg.de
Dr.	McNab, Fergus	GFZ, Sektion 4.6	mcnab@gfz-potsdam.de
	Meinsen, Janine	LBEG Niedersachsen	janine.meinsen@lbeg.niedersachsen.de
Prof.	Meister, Julia	Universität Würzburg	julia.meister@uni-wuerzburg.de
Dr.	Mingram, Jens	GFZ, Sektion 4.3	ojemi@gfz-potsdam.de
	Mohammednoor, Mosab Mohammed Alamin	TU Berlin	Mosab.Alamin@mfn.berlin
Dr.	Müller, Daniela	GFZ, Sektion 4.3	danielam@gfz-potsdam.de
Dr.	Nagavciuc, Viorica	AWI Bremerhaven	nagavciuc.viorica@gmail.com
	Nuss, Margarita	Universität Freiburg	margarita.nuss@outlook.de
	Pagels, Julia	FU Berlin	julia.pagels@fu-berlin.de
	Pechipaykoska, Ivana	GFZ, Sektion 4.3	ivana@gfz-potsdam.de
	Pflug, Katharina	GFZ, Sektion 4.3	kpflug@gfz-potsdam.de
Dr.	Plessen, Birgit	GFZ, Sektion 4.3	birgit@gfz-potsdam.de
	Pollhammer, Thomas	Universität Salzburg	thomaspollhammer@gmx.at
Prof.	Preusser, Frank	Universität Freiburg	frank.preusser@geologie.uni-freiburg.de
	Prochnow, Maximilian	Universität Jena	maximilian.prochnow@uni-jena.de
Prof.	Pross, Jörg	Universität Heidelberg	joerg.pross@rektorat.uni-heidelberg.de
	Puthenveedu Mohana-dasan, Sandeep	BTU	pmsandeep21@gmail.com
Prof.	Raab, Thomas	BTU	raab@b-tu.de
	Rahimzadeh, Neda	LIAG	Neda.Rahimzadeh@leibniz-liag.de
	Redant, Daniel Aaron	GFZ, Sektion 4.3	danielr@gfz-potsdam.de
	Rehbein, Moritz	GFZ, Sektion 4.3	mrehbein@gfz-potsdam.de
Prof.	Reimann, Tony	Universität Köln	t.reimann@uni-koeln.de
	Reiss, Lilian	FAU	lilian.reiss@fau.de
	Reiß, Antonia	JGU Mainz	areiss@uni-mainz.de
Dr.	Reitner, Jürgen	Geologische Bundesanstalt Wien	juergen.reitner@geologie.ac.at
Dr.	Richter, Christiane	TU Dresden	christiane_richter@tu-dresden.de
	Ringleb, Bastian	JLU Gießen	bastian.ringleb@geogr.uni-giessen.de
Dr.	Roettig, Christopher-B.	TU Dresden	christopher-bastian.roettig@tu-dresden.de
Dr.	Rother, Henrik	LAGB Sachsen-Anhalt	Henrik.Rother@sachsen-anhalt.de
	Rütters, Sophia	LBGR Brandenburg	Sophia.Ruetters@lbgr.brandenburg.de

	Name, Surname	**Institution**	**Email**
	Rustemeyer, Zara Seraphina	privat	z.s.rustemeyer@posteo.de
Dr.	Salcher, Bernhard	Universität Salzburg	bernhard.salcher@plus.ac.at
Prof.	Sauer, Daniela	GAU Göttingen	daniela.sauer@geo.uni-goettingen.de
	Schmalfuss, Clemens	BOKU	clemens.schmalfuss@boku.ac.at
Dr.	Schmidt, Johannes	Universität Leipzig, Geog	j.schmidt@uni-leipzig.de
	Schneider, Vera	FU Berlin	vera.schneider@fu-berlin.de
Dr.	Schwab, Markus J.	GFZ, Sektion 4.3	mschwab@gfz-potsdam.de
Prof.	Schwalb, Antje	TU Braunschweig	antje.schwalb@tu-braunschweig.de
	Sinapius, Ralf	Freiberufl. Bodengeologe	sinapius@bodenwissenschaft.de
Dr.	Sirota, Ido	HUJI / GFZ, Sektion 4.3	idosir@gfz-potsdam.de
	Sitko, Katarzyna	University of Silesia	katarzyna_luszczynska@o2.pl
	Skiba, Vanessa	PIK	skiba@pik-potsdam.de
Dr.	Słowiński, Michał	IGSO PAS Warschau	michal.slowinski@geopan.torun.pl
Dr.	Sprafke, Tobias	KOBO	tobias.sprafke@bfh.ch
	Starke, Joris Cornelius	privat	jorisstarke@gmail.com
	Steiner, Martin	Universität Freiburg	martinsteinermartin@yahoo.de
Dr.	Stephan, Hans-Jürgen	privat	hanjuest@t-online.de
	Stieg, Amelie	AWI Potsdam	amelie.stieg@awi.de
Dr.	Stojakowits, Philipp	LBEG Niedersachsen	Philipp.Stojakowits@lbeg.niedersachsen.de
	Stoof-Leichsenring, Kathleen	AWI Potsdam	kathleen.stoof-leichsenring@awi.de
Dr.	Strahl, Jaqueline	LBGR Brandenburg	jaqueline.strahl@lbgr.brandenburg.de
Dr.	Thiel, Christine	BGR	christine.thiel@bgr.de
Dr.	Tjallingii, Rik	GFZ, Sektion 4.3	rik.tjallingii@gfz-potsdam.de
Dr.	Treffeisen, Renate	AWI Bremerhaven	renate.treffeisen@awi.de
	Urban, Anais	GFZ, Sektion 4.3	anais.urban@web.de
	Vinnepand, Mathias	LIAG	mavinnep@uni-mainz.de
Dr.	von Suchodoletz, Hans	Universität Leipzig Geog	hans.von.suchodoletz@uni-leipzig.de
Dr.	Wansa, Stefan	LAGB Sachen-Anhalt	Stefan.Wansa@sachsen-anhalt.de
Dr.	Weidenfeller, Michael	LGB-RLP	michael.weidenfeller@lgb-rlp.de
	Wielandt-Schuster, Ulrike	RPF-LGRB	ulrike.wielandt-schuster@rpf.bwl.de
Prof.	Winkler, Stefan	Universität Würzburg	stefan.winkler@uni-wuerzburg.de
	Wittschen, Moritz Nepomuk	FU Berlin	wittschem03@zedat.fu-berlin.de
Dr.	Wolf, Daniel	TU Dresden	daniel_wolf@tu-dresden.de
Dr.	Wolter, Juliane	Universität Potsdam	juliane.wolter.1@uni-potsdam.de
Prof.	Wrozyna, Claudia	Universität Greifswald	claudia.wrozyna@uni-greifswald.de
	Wurz, Karla	GFZ, Sektion 4.3	kwurz@gfz-potsdam.de
Prof.	Zech, Roland	Universität Jena	roland.zech@uni-jena.de
Prof.	Zielhofer, Christoph	Universität Leipzig Geog	zielhofer@uni-leipzig.de
Prof.	Zolitschka, Bernd	Universität Bremen	zoli@uni-bremen.de

(last update September 22, 2022)

Acknowledgements:

The organizers are grateful for financial and logistical support from GFZ Potsdam.

ISSN 2190-7110