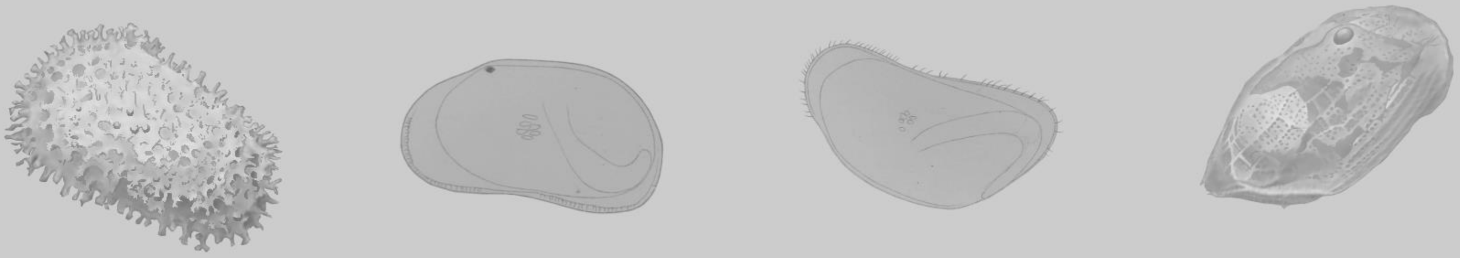

# Programme and Abstract Volume



# 9th EUROPEAN OSTRACODOLOGISTS' MEETING

GDAŃSK
POLAND

19-22.07.2019

EOM9

GDANSK-POLAND 2019

# Ninth European Ostracodologists' Meeting

## Crossing boundaries in ostracod research

# Programme and Abstract Volume

**Gdańsk, Poland**
**19-22 July 2019**

**Edited by**

**Tadeusz Namiotko**
**Agnieszka Kaczmarczyk-Ziemba**
**Agata Szwarc**

**Cover**

Cover was designed by Agnieszka Kaczmarczyk-Ziemba and includes lithographic images of various marine and non-marine ostracod species by late Gustav Wilhelm Müller.

Müller G.W. 1894. Die Ostracoden des Golfes von Neapel unter der angrenzenden Meeresabschnitte. Fauna und Flora des Golfes von Neapel, 21, 404 pp., 40 pls., R. Friedländer & Sohn, Berlin.

Müller G.W. 1900. Deutschlands Süsswasser-Ostracoden. Zoologica 30, 112 pp., 21 pls., Stuttgart.

**EOM9 Logos**

Both logos are based on an image of *Heterocypris incongruens* (Ramdohr, 1808). The "Horizontal ostracod" logo was designed by Patrycja Firkowska, whereas the "Vertical ostracod" logo by Bartosz J. Namiotko.

**Abstract review**

Enclosed abstracts were reviewed by the members of the Scientific Committee. Only limited language edition was provided in some cases to make the content more clear.

**Recommended reference to this publication**

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# FOREWARD

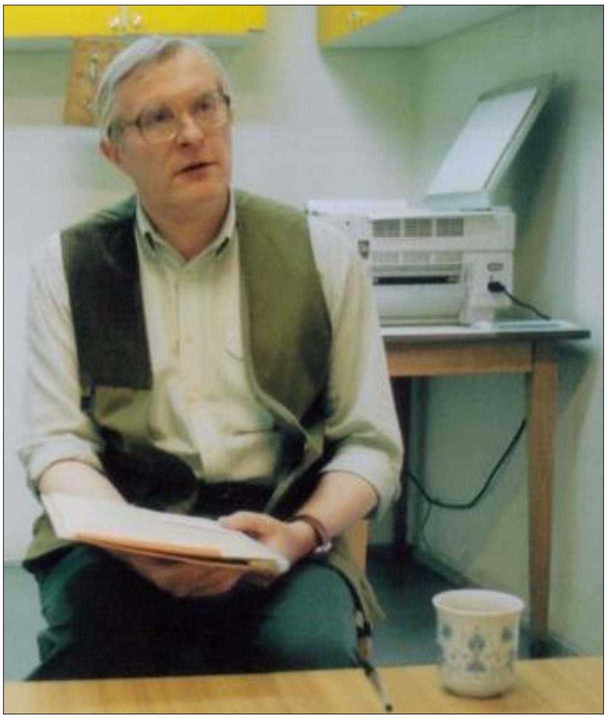
The European Ostracodologists' Meetings (EOMs) have been held since 1989, serving not only as an international forum for bringing ostracod scientists together to exchange views and ideas in friendly atmosphere, but also providing an opportunity to discuss collaborative research among peers and promoting ostracod research. 30 years after the first EOM in Frankfurt, Germany, the 9th European Ostracodologists' Meeting (EOM9) is held from 19 to 22 July 2019 in Gdańsk, one of the most famous and beautiful city in Poland. EOM9 is organized by the Department of Genetics and Biosystematics, Faculty of Biology, University of Gdańsk, with assistance of the Biological Station of the University of Gdańsk, and covers any aspects of science with Ostracoda under the theme "Crossing boundaries in ostracod research".

EOMs, supposedly European in focus, always attracted delegates from extra-European countries. EOM9 has also broad delegate catchment. 67 delegates (with eight accompanying persons) from 21 countries (including delegates from as far away as China, Japan and Thailand) are going to present in total 74 scientific contributions, including 3 keynote lectures, 38 oral and 34 poster presentations. The contributions deal with a wide range of topics, from the Silurian assemblages in the ancient Baltic Palaeobasin to the molecular taxonomy of the extant non-marine ostracods.

In addition to plenary sessions, two workshops and two excursions are offered. Finn Viehberg and Koen Martens proposed a workshop on African Ostracod Taxonomy whereas Mauro Alivernini and Peter Frenzel convened an open Workshop on Ostracoda in Environmental Micropalaeontology. In mid-symposium excursion all delegates will have a guided tour of historical Gdańsk and finally go to the Biological Station of the University of Gdańsk at the mouth of the Vistula River with brackish water habitats. The post symposium-trip comprises various coastal and inland landscapes and hydrobiological settings in the vicinity of Gdańsk.

The organizers are indebted to late Paweł Adamowicz and Aleksandra Dulkiewicz, the previous and current Mayors of Gdańsk as well as to Professor Jerzy Gwizdała, the Rector of the University of Gdańsk and to Professor Włodzimierz Meissner, the Dean of the Faculty of Biology, University of Gdańsk for the honorary patronage of this scientific event, financial support, facilities and help. The sponsors and partners (Hotel Artus, Opta-Tech, A&A Biotechnology, Kreativika, NSZZ Solidarność as well as International Research Group on Ostracoda and Society of Friends of IRGO) are greatly acknowledged for their support and advice to make a success of EOM9. The members of the Scientific Committee who evaluated the abstracts are thanked for their outstanding work.

# PRO MEMORIA



**TADEUSZ SYWULA**
**(1939-2004)**

**The 9th European Ostracodologists' Meeting is dedicated to Prof. Dr. rer. nat. habil. Tadeusz Sywula who initiated ostracod research in Gdańsk.**

Tadeusz Sywula was born on the 21st of September 1939 in Warsaw, Poland. He graduated from Adam Mickiewicz University Poznań, Poland in 1962 and joined the Institute of Zoology, Polish Academy of Sciences as a technician. He was promoted to post-doctoral scientist straight afterwards he received his PhD in natural sciences also from the Adam Mickiewicz University in 1966. His doctoral thesis dealt with faunistic studies on Ostracoda and Copepoda of inland saline areas of Poland. In 1974 he published a creditable monograph on non-marine Ostracoda of Poland with excellent drawings and identification keys prepared with great care. Unfortunately, at that time of an ideological barrier of the Iron Curtain this work was published in Polish and hardly available for colleagues from Western Europe. It became, however, a primary reference for Polish ostracodologists. It was also that work that gained him his post-doctoral degree (habilitation). Following his habilitation, he moved in 1976 to the University of Gdańsk and joined the Department of Invertebrate Zoology, setting up a small Laboratory of Experimental Systematics, which morphed into the Department of Genetics (currently Department of Genetics and Biosystematics). T. Sywula continued his research career at the University of Gdańsk, where he gained the professorship in 1989, while in 1994 he became a Full Professor. In 1984 he got involved in an administrative work, becoming a Vice-Dean and later a Dean of the Faculty of Biology, Geography and Oceanology, a Chair of the Biology Council or an elected active member of various committees of the Polish Academy of Sciences, and fulfilled these duties until 2004.

Tadeusz Sywula was a scrupulous zoologists carcinologists specialising in taxonomy and ecology of extant European non-marine or brackish water ostracods. He published ca. 60 papers, monographies and book chapters describing two new ostracod genera and 20+ new species or subspecies. Four new species (three ostracods and one amphipod) got patronymic names in his honour proving his international reputation. He also pioneered in 1982 studies on ostracod population genetics and clonal genetic diversity, using at that time a technique of allozyme electrophoresis. He supervised seven Ph.D. and tens of M.Sc. projects, always expecting high academic standards.

Tadeusz Sywula was a modest and honest man, bringing optimism to those who knew him. He was always ready to help if anybody (either a student or a colleague professor) asked him for advice or assistance. There were no unreachable tasks for him, issues impossible to solve. He was always optimistic about the world and people and was able to point out positive sides at tough times in life.

Professor Tadeusz Sywula passed away suddenly during his field trip to Macedonia on the 23rd of August 2004, aged 65.

He remains in our memory as a truly great person with an ever-present cup of tea.

## List of publications on Ostracoda by Tadeusz Sywula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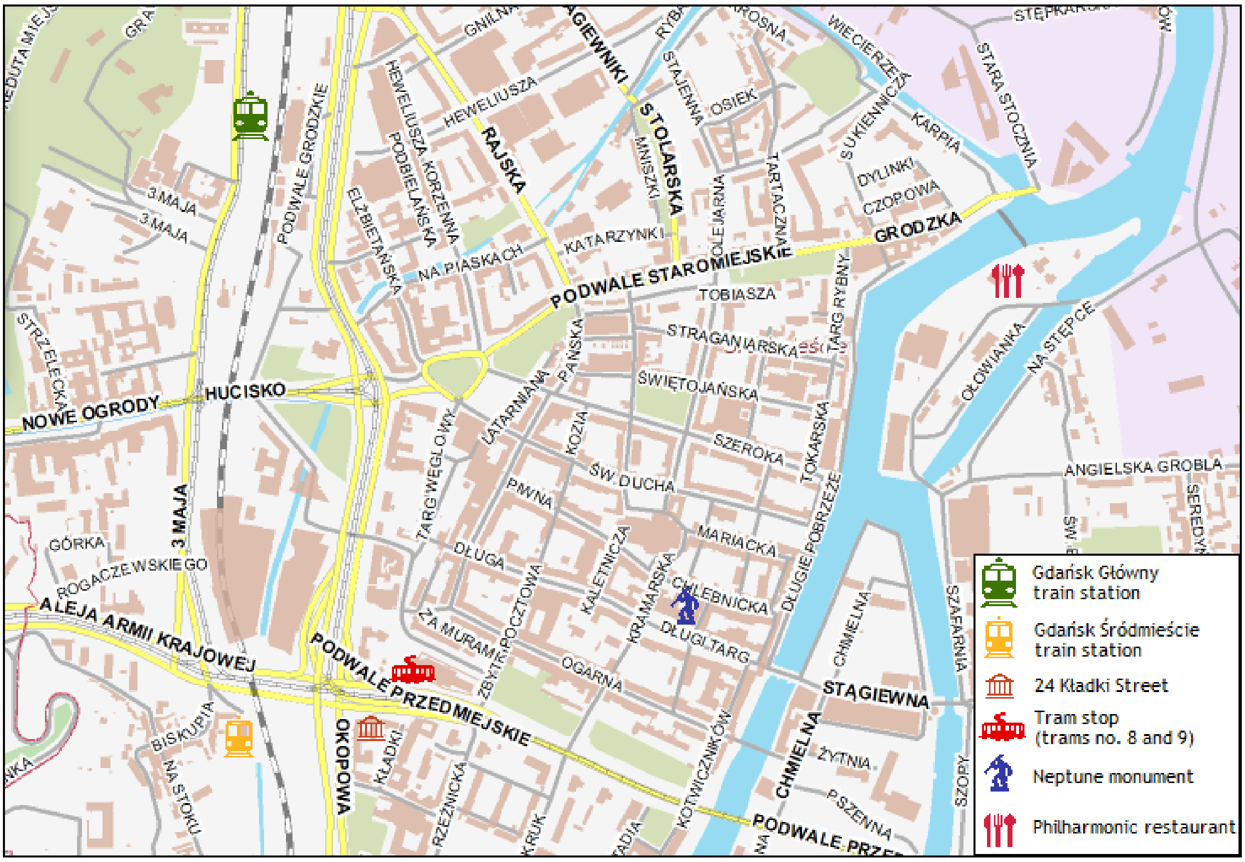
# GENERAL INFORMATION ABOUT THE MEETING

## VENUE

EOM9 will be held at the University of Gdansk, in a historical building (former Victoria School) conveniently located at 24 Kładki street near-by Main Town (see map below).




## SCHEDULE IN BRIEF

| | |
|---|---|
| 17th July | Arrival in Gdańsk for pre-conference African Ostracod Taxonomy Workshop |
| 18th July | Arrival in Gdańsk, African Ostracod Taxonomy Workshop, Registration, Ice-breaker |
| 19th July | Plenary Sessions, Ostracoda in Environmental Micropalaeontology Workshop |
| 20th July | Mid-conference excursion and Social evening |
| 21th July | Plenary sessions, open SF*IRGO General Assembly, EOM Business Meeting |
| 22nd July | Plenary sessions, Poster session, Conference Dinner |
| 23-24th July | Post-symposium field trip |

## REGISTRATION

18th July 18:00-22:00 Conference Desk in Conference Venue
19th July 9:00-11:00 Conference Desk in Conference Venue
For late registration after this time, locate organizers.

## ORAL PRESENTATIONS

Oral presentations are 15 minutes including discussion. Due to the tight schedule, speakers are requested to respect strictly the allowed time. Speakers with PowerPoint please liaise in advance with the Conference Desk. Power Point (or PDF) presentations of the morning sessions should be delivered to the organizers before 9:00 or in the late afternoon of the day before. For the afternoon sessions presentations will be uploaded during lunch time of the same day. Use of personal laptops will generally be not allowed. In case a presentation includes links to external files, please contact organizers in advance.

## POSTERS

Posters should be in a portrait orientation and not exceed the size of the B1 format (70 x 100 cm). Please deliver your posters during the registration for mounting by the organizers. Posters will be displayed on 21st and 22nd July in order as numbered in the programme. During the Poster Session authors are requested to be available at their display board to discuss their work. Please remove your posters after the Poster Session, before the Conference Dinner.

## LUNCH

Lunches for four days are included in the fee and will be provided in the conference venue (excepting the mid-symposium excursion day on 20 July when lunch will be provided in the restaurant Filharmonia).

## AWARDS

In order to recognise outstanding contributions of junior participants (before PhD), two awards will be granted. Voting card will be included in the conference materials.

## REGISTERED ACCOMPANYING PERSONS

Accompanying persons are welcome to all social events (ice-breaker reception on 18th July, Social Evening on 20th July and Conference Dinner on 22nd July) as well as to the mid-congress excursion including lunch (on 18th July). The registration fee also covers conference bag and polo-shirt.

## INSURANCE

There is no insurance included in the registration fee. All delegates are advised to make their own arrangements for the duration of the symposium and the field trip.
General emergency phone number in Poland is: **112**.

# SCIENTIFIC PROGRAMME

## Thursday 18th July

### 9:00–17:00 African Ostracod Taxonomy Workshop

Conveners: Finn Viehberg and Koen Martens
Location: Biological Station of the University of Gdansk (BSUG) – Ornitologów 26, Gdańsk-Górki Wschodnie
9:00 Participants meet at the conference venue – Gdańsk at 24 Kładki street for shuttle/public transport to BSUG (ca. 30 min)
Workshop is limited to registered participants: Derya Akdemir, Mauro Alivernini, Maria João Fernandes Martins, Peter Frenzel, Olga Gildeeva, Tamara Karan-Žnidaršič, Koen Martens, Ilaria Mazzini, Tadeusz Namiotko, Agata Szwarc, Finn Viehberg, Monika Wasążnik and Dangpeng Xi.
All inquiries to Finn Viehberg (finn.viehberg@uni-greifswald.de) or local contact Tadeusz Namiotko (tadeusz.namiotko@ug.edu.pl)

**18:00–22:00**: **Registration and Ice Breaker Social** in the Conference Venue

## Friday 19th July

SESSIONS WITH PRESENTERS AND TITLES
(highlighted in light gray to be considered for best junior contribution)

| | | |
|---|---|---|
| 9:00-9:15 | M. Yasuhara, T. Namiotko | Welcome and Introduction |
| **KEYNOTE LECTURE 1** | | |
| 9:15-10:15 | D.L. Danielopol (with contribution of K. Swanson) | Ostracod Phylogeny and Evolution – Thirty years after the "Manawan Perspective"<br>The necessary 3-D Visualisation of Ostracod morphological traits - Presentation of K. Swanson's „Bugs of the Ocean" |
| 10:15-10:45 | COFFEE BREAK | |
| **PLENARY SESSION 1: PALAEOZOIC OSTRACODS** Convener: B. SAMES | | |
| 10:45-11:00 | T. Meidla | The end-Ordovician "interesting times" in the ancient Baltic Palaeobasin |
| 11:00-11:15 | V. Perrier | Silurian myodocope ostracods from Poland |
| 11:15-11:30 | S. Rinkevičiūtė | The impact of the Mulde bioevent (Lower Silurian) on Ostracod ecological dynamics |
| **PLENARY SESSION 2: MESOZOIC NON-MARINE OSTRACODS** Convener: T. MEIDLA | | |
| 11:30-11:45 | M.A. Naumcheva | New method of describing smooth ostracod shells |
| 11:45-12:00 | B. Sames | The Central Tunisian Atlas as a biogeographic crossroad: Insights from a potential key area for mid-late Mesozoic non-marine ostracod and charophyte research |
| 12:00-12:15 | Z. Qin | Taxonomy, biostratigraphy and palaeoecology of Early Cretaceous non-marine ostracods in Luanping Basin of northern Hebei, North China |
| 12:15-12:30 | H. Wang | Biostratigraphic and palaeoenvironmental significance of Campanian-early Maastrichtian (Late Cretaceous) ostracods from the Jiaozhou Formation of Zhucheng, Shandong, China |
| 12:30-13:30 | LUNCH | |
| **PLENARY SESSION 3: MESOZOIC MARINE OSTRACODS** Convener: D. HORNE | | |
| 13:30-13:45 | M.-B. Forel | New insights into the rise of Meso-Cenozoic marine ostracods |
| 13:45-14:00 | M.C. Cabral | Ostracod biostratigraphy of the Toarcian (Lower Jurassic) GSSP, Peniche, Portugal |
| 14:00-14:15 | M. Franz | New results on the ostracod fauna from the Aalenian and Lower Bajocian of SW Germany |
| 14:15-14:30 | A. Lord | Normal pore canals in ostracod taxonomy: the case of *Minyocythere* |
| 14:30-14:45 | Y.A. Shurupova | Male-driven evolution in the ostracod genus *Lophocythere* from the Middle Jurassic of the Russian Plate |
| 14:45-15:00 | Y. Wang | The ornamentation of *Vlakomia* and its possible relation to a transgression event |
| 15:00-15:15 | M.J. Fernandes Martins | Shifts in sexual selection across the Cretaceous/Paleogene mass extinction boundary in cytheroid ostracodes |

| | |
|---|---|
| 15:15-15:45 | COFFEE BREAK |
| 15:45-18:45 | **Ostracoda in Environmental Micropalaeontology open Workshop**<br>Conveners: Mauro Alivernini (mauro.alivernini@uni-jena.de) and Peter Frenzel (peter.frenzel@uni-jena.de)<br>After a short overview by the conveners and short (up to 5 min) presentations from own work of participants (if applicable), everybody is welcome to the general discussion forum. |

## Saturday 20th July

### 10:00–23:00 Mid-conference excursion and social evening

Programme:

10:00 – Participants meet at the EOM9 venue – Gdańsk at 24 Kładki street where the guided tour starts
12:45 – Lunch at the Filharmonia restaurant
14:30 – Meeting at the marina on Długie Pobrzeże near the Green Gate to embark on a ship Galeon Lew (Lion)
15:00 – Cruise to Westerplatte
15.40 – Westerplatte guided tour
17:00 – Shuttle to Biological Station of the University of Gdańsk (Gdańsk-Górki Wschodnie)
18:00 – Social evening at the Biological Station of the University of Gdańsk, including food & beer and live music
22:30 – Leave for Gdańsk Main Town
23:00 – Arrive Conference Venue

Note: Mid-symposium excursion and social evening is open to all participants and accompanying persons. The guided tour, lunch, cruise to Westerplatte and social evening in the Biological Station are included in the conference fee. Please, however, pay for your own drinks with lunch.

## Sunday 21th July

SESSIONS WITH PRESENTERS AND TITLES
(highlighted in light gray to be considered for best junior contribution)

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| **KEYNOTE LECTURE 2** | | |
| 9:00-9:45 | M. Yasuhara | Deep-sea biodiversity: an ostracod perspective |
| **PLENARY SESSION 4: NEOGENE NON-MARINE OSTRACODS** Convener: T. KARAN-ŽNIDARŠIČ | | |
| 9:45-10:00 | M. Spadi | The Pannonian ostracod fauna from the Zalanyi's type section of Obrenovac (Serbia) |
| 10:00-10:15 | R. Matzke-Karasz | Preservation of Ostracoda in Miocene Amber from Chiapas, Mexico, revealed by synchrotron tomography techniques |
| 10:15-10:45 | COFFEE BREAK | |
| **PLENARY SESSION 5: QUATERNARY AND RECENT MARINE OSTRACODS** Convener: J. RODRIGUEZ-LAZARO | | |
| 10:45-11:00 | M.A. Zenina | Quaternary ostracod assemblages of the northeastern Black Sea shelf |
| 11:00-11:15 | I. Mazzini | Palaeoenvironmental evolution of an active rift basin through ostracod analysis: the example of the Corinth Gulf (IODP Leg 381) |
| 11:15-11:30 | H.-H.M. Huang | Benthic faunal responses to deoxygenation and Pleistocene climate events, the Sea of Japan |
| 11:30-11:45 | Y. Hong | Holocene sea-level changes in Hong Kong: reconstruction based on ostracod assemblages in a sediment core |
| 11:45-12:00 | S.Y. Tian | Deglacial-Holocene Svalbard paleoceanography and evidence of Melt Water Pulse 1B |
| 12:00-12:15 | M.C. Cabral | Recent ostracod assemblages from the eastern Algarve continental shelf, Portugal |
| 12:15-12:30 | S. Yamada | Cuticle ultrastructure and calcification in the carapace of the myodocopan ostracod *Euphilomedes japonica* |

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| 12:30-13:45 | LUNCH | |
| **PLENARY SESSION 6: QUATERNARY NON-MARINE OSTRACODS** Convener: G. ROSSETTI | | |
| 13:45-14:00 | K. Sohar | A new non-marine ostracod fauna from Pleistocene sediments (MIS11) at Little Cornard, Suffolk, UK |
| 14:00-14:15 | M. Wasążnik | Tracking the Older Holsteinian Oscillation: a high-resolution ostracod record from Eastern Poland |
| 14:15-14:30 | D. Akdemir | *Limnocythere* species as ecological and isotopic indicators of lake water salinity changes: The Lake Van example |
| 14:30-14:45 | V. Hajek Tadesse | Holocene Ostracoda (Crustacea) from the Baćina lakes (Dalmatia, Croatia) |
| 14:45-15:00 | M. Alivernini | Ostracods as indicators for climatic and environmental changes on the Tibetan Plateau |
| 15:00-15:15 | A. Pint | Ostracod investigations as part of multiproxy analyses - case studies from two ancient harbours |
| 15:15-15:45 | COFFEE BREAK | |
| 15:45-18:00 | **open SF*IRGO General Assembly, Regional meetings** | |

## Monday 22nd July

SESSIONS WITH PRESENTERS AND TITLES
(highlighted in light gray to be considered for best junior contribution)

| | | |
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| **KEYNOTE LECTURE 3** | | |
| 9:00-9:45 | K. Martens | The influence of urbanisation on diversity and occurrence of non-marine ostracod species (Crustacea, Ostracoda) |
| **PLENARY SESSION 7: RECENT NON-MARINE OSTRACODS** Convener: C. MEISCH | | |
| 9:45-10:00 | D.J. Horne | Towards a Holarctic view of living non-marine ostracod distribution: taxonomic harmonisation of databases |
| 10:00-10:15 | D.L. Danielopol | On two types of taxonomic chimaeras within ostracod systematics |
| 10:15-10:45 | COFFEE BREAK | |
| 10:45-11:00 | D. Výravský | Environmental stability of Western Carpathian spring-fens and its influence on Ostracod assemblages |
| 11:00-11:15 | B. Scharf | Colonization on the rooftop of 'Bunker Valentin' in Bremen, Germany by Ostracoda and Cladocera (Crustacea) |
| 11:15-11:30 | Á. Baltanás | Does ostracod valve shape respond to subtle environmental changes? |
| 11:30-11:45 | F. Viehberg | How do cryptic species look like in the fossil record? |
| 11:45-12:00 | A. Kilikowska | DNA barcoding reveals cryptic diversity in a non-marine ostracod morphospecies *Heterocypris salina* (Brady, 1868) |
| 12:00-12:15 | M. Kijowska | Taxonomy of Candoninae (Ostracoda): molecular insights into a difficult problem |
| 12:15-12:30 | T. Namiotko | Co-habiting non-marine ostracods harbor host-specific microbiota |
| 12:30-13:45 | LUNCH | |

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| 13:45-15:45 | **POSTER SESSION** | |
| No. | Presenter | Title |
| highlighted in light gray to be considered for best junior contribution | | |
| 1 | V. Perrier | Ecologically distinct Silurian ostracod faunas from a single horizon in Spain |
| 2 | W. Mette | Microfossils, chemostratigraphy and environmental changes in the Late Triassic (Rhaetian) of the Northern Alps (Austria) |
| 3 | Y. Wang | Early Cretaceous non-marine ostracod biostratigraphy of northeast China |
| 4 | B. Sames | An enigmatic gigantic marine ostracod trapped in Burmite (mid-Cretaceous amber of Myanmar) |
| 5 | D. Xi | Late Cretaceous-Early Paleogene biostratigraphy and stable isotopes of ostracod in the Songliao Basin, NE China |
| 6 | A.T. Javadova | Pliocene microfauna, stratigraphy and palaeoenvironment of the Productive and Red Series in the South Caspian Basin |

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|---|---|---|
| 7 | G. Salvi | Ostracode and foraminifer response to a Late Pleistocene-Holocene volcanic activity in northern Victoria Land as recorded in Ross Sea (Antarctica) marine sediments |
| 8 | J. Rodriguez-Lazaro | Deep-sea benthic ostracods response to palaeoclimatic changes (MIS 5-Holocene, S Bay of Biscay) |
| 9 | O. Gildeeva | Recent brackish water Ostracoda and Foraminifera from two lagoons of Ghana, and their potential as environmental indicators |
| 10 | M.-B. Forel | Marine sediments in the micropalaeontology collections of the Muséum national d'Histoire naturelle: overview and potentials |
| 11 | K. Błachowiak-Samołyk | Biogeography of planktonic ostracods across different hydrographical zones of Drake Passage (Southern Ocean) |
| 12 | M. Mohammed | Holocene freshwater ostracods from the highlands of Yemen and their paleoclimatic implications |
| 13 | K. Martens | Does fractal dimensions of *Salvinia* species change the composition of ostracod communities in tropical floodplain lakes? |
| 14 | K. Martens | Extreme drought periods can change spatial effects on periphytic ostracod metacommunities in river-floodplain ecosystems |
| 15 | K. Martens | Predicting the potential invasive distributions of native South American ostracods to the African continent |
| 16 | K. Martens | A striking case of convergent evolution in two species of Cypricercinae (Crustacea, Ostracoda), with the description of a new genus and species from Brazil |
| 17 | K. Martens | Spatial variation of ostracod (Crustacea, Ostracoda) egg banks in temporary lakes of<br>a tropical floodplain |
| 18 | K. Martens | Description of a new species of *Cypricercus* and of the male of *Cypricercus centrurus* (Klie, 1940) (Crustacea, Ostracoda) from Brazil |
| 19 | K. Martens | New species of the genus *Elpidium* (Ostracoda, Limnocytheridae) from New Caledonia: alien invasives without a risk! |
| 20 | S. Savatenalinton | A new genus of the tribe Zonocypridini (Crustacea, Ostracoda, Cypridopsinae) from Thailand |
| 21 | A. Szwarc | Environmental influences on ostracod assemblages in endorheic wetlands of the North West Province, South Africa |
| 22 | R. Matzke-Karasz | Ostracod Research in Morocco, Algeria, Tunisia, Libya and Egypt |
| 23 | S. Iepure | Ostracod metacommunities from Mediterranean temporary ponds: regional variations and driving factors |
| 24 | M. Mioduchowska | Molecular evidence of widespread prevalence of intracellular bacteria *Cardinium* in parthenogenetic females of an ostracod *Heterocypris salina* (Brady, 1868) |
| 25 | K. Martens | Cryptic species in *Cypridopsis vidua* |
| 26 | K. Martens | Horizontal gene transfer in the putative ancient asexual ostracod *Darwinula stevensoni* |
| 27 | T. Karan-Žnidaršič | The Wouters organ presence and its detecting in *Heterocypris* |
| 28 | T. Karan-Žnidaršič | The valve shape variability in ten species of *Heterocypris* occurring in Europe |
| 29 | J. Baran | Valve shape variation in a non-marine ostracod morphospecies *Heterocypris salin*a (Brady): Geometric morphometrics approach |
| 30 | T. Namiotko | Power frequency electromagnetic field (50 Hz) affect life history traits of a temporary water ostracod *Heterocypris incongruens* (Crustacea, Ostracoda) |
| 31 | A. Szlauer-Łukaszewska | Survival rate of ostracods after exposure to freezing |
| 32 | B. Wojtasik | Assessment of toxicity of contaminated bottom sediments using biotests based on stress reaction of *Heterocypris incongruens* and *Candona rectangulata* |
| 33 | B. Wojtasik | The interaction of new starch based polymer compositions with *Candona rectangulata* in biotest (CrecTest) |
| 34 | B. Wojtasik | *Candona rectangulata* Alm, 1914 as a palaeoclimatic indicator |

## 15:45-16:00 Concluding remarks and Closing ceremony

## 19:00-23:00 Conference Dinner at Filharmonia restaurant

## Tuesday-Wednesday 23-24 July

**POST-CONFERENCE FIELD TRIP**

Various coastal and inland landscapes and hydrobiological settings in the vicinity of Gdańsk.

Trip is limited to participants and accompanying persons who registered:
Ángel Baltanás, Tamara Karan-Žnidaršič, Dietmar Keyser, Renate Matzke-Karasz, Michael Karasz, Munef Mohammed, Maria Naumcheva, Yuriy Naumchev, Yana Shurupova, Finn Viehberg, David Výravský, He Wang, Dangpeng Xi, Dada Yan.

Leaders: Monika Mioduchowska, Agata Szwarc and Tadeusz Namiotko

All inquiries to tadeusz.namiotko@ug.edu.pl

Agenda

**23rd July**
**9:30** Participants meet in the conference venue – Gdańsk at 24 Kładki street for shuttle to bustling Sopot from where a cruise will get us to the Hel Peninsula (ca. 1.5 h). We will visit the Hel Marine Station (Inst. Oceanogr., Univ. Gdansk), situated at the very end of the peninsula and try to collect ostracods from interstitial waters of the Baltic sandy shores and from brackish waters of peaty meadows.

**24th July**
We will depart early and go through Coastal Landscape Park, seeing various coast types, including bright beaches and up to 40-m-high cliffs with pre-Quaternary formations at the bottom overlaid by glacial and Holocene sediments were we could search for freshwater fossil ostracods. We will proceed to the Słowiński National Park SNP (UNESCO Biosphere Reserve) to visit “moving dunes”, coastal lakes, numerous fresh- and brackish water wetlands and seaside forest. On the way back we will travel through Kashubian Landscape Park and stop for a while at a through postglacial Lake Raduńskie Górne to collect lacustrine littoral ostracods. You will then be transferred back to Gdansk for overnight.

Price includes: transportation, accommodation for two nights, SPN entrance fee and guided tour, fees for lecture room/lab in Hel Marine Station. Food is not included.

# ABSTRACTS

# KEYNOTE ABSTRACTS

**Ostracod phylogeny and evolution – Thirty years after the "Manawan Perspective"**

Dan L. DANIELOPOL[1] (with contribution of Kerry SWANSON[2])

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The first part of the talk briefly recounts the way the idea of an European Ostracod Meeting (EOM) started (details of this event exist also in the reports of Heinz Malz and Alan Lord published in the journals of the Senckenberg Museum, *Courier* volume 113 and *Natur und Museum*). A unique impression at the first EOM (1989) was left by the communication of Kerry Swanson dealing with the morphology of an ostracod *Manawa staceyi* described in detail during this event. Swanson's presentation stimulated many later discussions. *Manawa staceyi* appears now as one of the most primitive Podocopa ostracods belonging to a superfamily Puncioidea with few species, both fossil and Recent ones. From the very beginning the puncioid ostracods, known mainly through their valves (*M. staceyi* is the unique species for which information on limbs exists), were considered to have phylogenetic affinities with the largely extinct order Palaeocopida whose species were documented mainly during the Palaeozoic era. David Siveter based on studies of Silurian ostracods bearing limbs demonstrated that some supposed Palaeocopida taxa where in fact myodocopes. Hence he urged cautioning the interpretation of palaeocopid systematics when based on exclusively shell ostracod record.

The second part of my talk deals with a re-examination of the systematic position, phylogenetic affinities and evolution of the superfamily Puncioidea. I will discuss the peculiar morphology of *M. staceyi* using the deconstruction of its body plan in several morpho-functional modules: the carapace as organismic protection system, the ambulatory complex, combined with the feeding system and the reproductive module, combined with the sensory one. The significant traits of the different morpho-functional modules of the superfamily Puncioidea when compared to those of ostracods belonging to the orders Podocopida and Platycopida offer arguments to consider the former taxon a phylogenetic lineage within the subclass Podocopa, with affinities to the latter two orders. For these considerations the taxon name Punciocopida proposed by Roger Schallreuter, but seldom used, appears well suited and makes it necessary to abandon the idea of puncioids as members to the debatable order Palaeocopida. A series of peculiar morphologic traits of *M. staceyi* are interpreted as evolutionary innovations within the subclass Podocopa. The realisation of these morphologies is probably the expression of so-called deep genetic homologies existing at the level of cellular regulatory systems. The following complex of morpho-functional traits are discussed: the maxillulary endopodite, the naupliar univalve shield, the 8th body limb, the valves closing system, the structure and the position of the 2nd antenna continued with the 5th to 7th pair of limbs.

The last part of the talk deals with the examination of the discrepancy between the low species diversity of Punciocopida and those of highly species-rich ostracod groups belonging to the non-marine Podocopida. There are nowadays five living puncioid species belonging to three genera while non-marine Podocopida display more than 2000 species. A non-trivial possible explanation is proposed using the Niche Construction concept.

**Acknowledgements**
Tadeusz Namiotko, the convener of the EOM-9, invited this talk as a keynote lecture. I thank him for this honour. The discussions and unpublished information I received from Kerry Swanson prompted to associate him as a contributor to this presentation. I deeply acknowledge his generosity. The logistic support offered by Werner E. Piller over many years at the Institute of Earth Sciences (Geology & Palaeontology), University of Graz, is highly appreciated. For many scientific discussions and information the following colleagues and friends are acknowledged: Ángel Baltanás, Giorgio Benassi, M. Cristina Cabral, Patrick De Deckker, Martin Gross, David J. Horne, William F. Humphreys, Alan Lord, Rosalie F. Maddocks, Koen Martens, Todd Oakley, Jørgen Olesen, Valeria Rossi, David J. Siveter, Robin J. Smith, Akira Tsukagoshi, Jean Vannier and Karel Wouters. Permission to use copyright material (where no open access exists) is here acknowledged: *Courier Forschungsinstitut Senckenberg* (Peter Königshof and Isabell Clasen), *Mitteilungen aus dem hamburgischen Zoologischen Museum und Institut* (Thomas Kaiser, Martin Schwentner and Angelika Brandt) and *Micropaleontology Press* (Rosalie F. Maddocks).

# The influence of urbanisation on diversity and occurrence of non-marine ostracod species (Crustacea, Ostracoda)

Marie COURS[1*], Isa SCHÖN[1*], Janet HIGUTI[2], Koen PARMENTIER[1], Marc KNOCKAERT[1], Tasnim PATEL[1], Frederik HENDRICKX[3], Jan VANAVERBEKE[1] and Koen MARTENS[1]

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Man has influenced natural environments for thousands of years. In the last few centuries, urbanisation has become one of the major drivers of ecology and adaptation for natural animal and plant populations. Urbanisation is the second largest cause of habitat destruction world-wide and can lead to reduced species richness and diversity. In 2014, 81 freshwater shallow ponds in Flanders were sampled for ostracods using a hand net with a mesh size of 160 µm. At the same time, several abiotic variables (temperature, pH, …) were measured in situ and water was collected for subsequent lab analyses of multiple water chemistry variables. These ponds were sampled within the unique nested sampling design characterising the SPEEDY project (SPatial and environmental determinants of Eco-Evolutionary DYnamics: anthropogenic environments as a model). This hierarchical plot and subplot sampling design was set out to enable the selection of sites over a gradient in urbanisation at two spatial scales in a standardized way. 27 plots of 3 x 3 km were selected, 9 with high (red), 9 with intermediate (yellow) and 9 with low urbanisation (green). Within each of the 27 plots, 3 subplots of 200 x 200 m were selected (red, yellow and green) based on the same urbanisation criteria as those at plot level. Ostracods were sorted from the samples with a binocular microscope (Leica MZ16) after which they were stored in pure EtOH at 4°C. We conducted a PERMANOVA to test for the effect of urbanisation level on the ostracod community. However, no significant effect was found. Data exploration and reduction of the water chemistry variables was performed following the protocol of Zuur *et al.* (2009). Distance-based linear modelling (DistLM), a stepwise selection procedure with Akaike information criterion, was performed to analyse the effect of the water chemistry variables on the ostracod community. The model that best explains the structure of the ostracod community contains the variables $NH_4^+$ and dissolved organic phosphorus (DOP). *Cypridopsis vidua* and *Cypria ophthalmica*, two common ostracod species, were selected as target species. A significant effect ($p = 0.022$) of urbanisation on subplot level on the presence of *C. ophthalmica* was found, but no such effect was found for *C. vidua*. Using mixed models, we detected significant effects of the urbanisation level of subplots on pH, Si, $NO_2^-$, $PO_4^{3-}$ and $NH_4^+$. Moreover, it appears that the presence of the two target species *C. ophthalmica* and *C. vidua* is influenced by $NH_4^+$ concentrations.

**Acknowledgments**
The SPEEDY project was funded by Belspo, the Belgian Science Policy.

**References**

Zuur A.,Ieno E.N., Walker N., Saveliev A.A., Smith G.M. 2009. *Mixed Effects Models and extensions in Ecology with R*. Springer Verlag, New York, 529 pp.

## Deep-sea biodiversity: an ostracod perspective

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Deep-sea biodiversity changes both in space and time. Regarding spatial patterns, for example, there are more species in the tropics and less species in the Arctic Ocean, constituting the latitudinal diversity gradient, one of the most pervasive ecological patterns on Earth. We know much less regarding the biodiversity changes with time, because deep-sea long-term monitoring is difficult and does not persist beyond a few decades. Fossils are basically the only direct records of deep past biodiversity. Ostracods are small, bivalved crustaceans with the finest-scale fossil resolution of any metazoan, and thus an ideal model system to study deep-sea biodiversity both in space and time. This presentation will show a synthesis of deep-sea species diversity patterns and their causes, using benthic deep-sea ostracod as a model system. Deep-sea biodiversity has clearly responded to global climate changes.

# ORAL ABSTRACTS

# *Limnocythere* species as ecological and isotopic indicators of lake water salinity changes: The Lake Van example

Derya AKDEMIR[1], Jeremy McCORMACK[2], Finn VIEHBERG[1,3], Claudia WROZYNA[4], Adrian IMMENHAUSER[2] and Ola KWIECIEN[2]

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We analysed sediment material from terminal and alkaline Lake Van (Turkey) covering the last 150 kyr from composite core material retrieved within the International Continental Scientific Drilling Program (ICDP) PaleoVan project (McCormack *et al*. 2019). The period is characterized by a low species diversity and changes in the concentration of total dissolved salts in the aquatic environment are displayed by changes in the ostracod species composition. *Limnocythere inopinata* is present throughout the studied interval, while *Limnocythere* sp. A is restricted to the Last Glacial period and related to increased lake water salinity and alkalinity. The presence of species belonging to the genus *Candona* is limited to periods of lower salinity. In an attempt to assess ostracod ecology (taxonomic diversity and valve morphology) combined with valve geochemistry ($\delta^{18}O$ and $\delta^{13}C$) we evaluated species of *Limnocythere* as palaeosalinity indicators. Although the occurrence of noded individuals and the number of nodes per valve is higher at periods of inferred high salinity, the relative number of noded individuals increased again in the Holocene, contrary to the Last Glacial period, the absolute size and number of nodes are smaller. Therefore, it is suggested that there is no linear relationship in relative abundance of noded valves and salinity. In addition to the nodes, other carapace ornamentation in terms of first (fossae and muri) and second (fossae with pits) order reticulation were investigated as qualitative features, and geometric morphometrics were used on carapace shape and size to evaluate morpho-traits in *Limnocythere* species in context of taxonomy and biogeography. The results reveals that carapace shape and ornamentation in females and males of *Limnocythere inopinata* differ significantly throughout the profile.

**References**

McCormack J., Viehberg F., Akdemir D., Immenhauser A., Kwiecien O. 2019. Ostracods as ecological and isotopic indicators of lake water salinity changes: the Lake Van example. *Biogeosciences* 16 (10): 2095-2114.

# Ostracods as indicators for climatic and environmental changes on the Tibetan Plateau

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Recent studies of ostracod assemblages from modern water bodies of the Tibetan Plateau and palaeoenvironmental records provide the basis to assess the environmental and societal impact of recent global change on the Tibetan Plateau, especially with regard to moisture changes and runoff of large rivers in its densely populated eastern and southern foreland and to compare the amplitude and timing of environmental change with those of the pre–industrial history. This study aims to contribute to a better understanding and improving the ostracods as reliable indicators for the environmental and social impact of recent global change on the Tibetan Plateau. The synthesis of ostracod-based environmental reconstruction and chronology from Taro Co and Tangra Yumco reveals the evolution of the lake systems during the Late Quaternary.

A comparison between these systems and other lakes on the whole Southern Tibetan Plateau showed several synchronisms among them, allowing an interpretation of the interplays among the monsoonal components. Results indicate a stronger Indian Monsoon for the period between 30 and 22 ka, followed by a discontinuous strengthening of the East Asian Monsoon until the Early Holocene. After this, the lake levels generally decreased in the whole Southern Tibetan Plateau. At around 2.4 ka the influence of the East Asian Monsoon intensity grew its influence and in Nam Co, Tangra Yumco and Taro Co rising lake levels are recorded. This multi-proxy approach proved to be valuable for a synthesis of palaeoenvironmental reconstruction and morphological data, resulting in a partial revision of the previous estimations of lake volume changes. Such changes are indicators of climatic conditions, especially monsoonal influence.

**Does ostracod valve shape respond to subtle environmental changes?**

Ángel BALTANÁS and Mariana JÁUREGUI

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In the last decades, our understanding of the ostracod carapace shape and its variability has increased significantly boosted by innovative morphometric techniques. Although data available are still far from comprehensive or irrefutable, one statement can be proposed: at the intra-specific level, shape variability is mainly cued by environmental factors. This is a simple idea with substantial consequences as it implies that carapace shape variability could be used to trace environmental changes along time. Of course, one key question concerns the sensitivity and consistency of carapace shape changes in response to changes in environmental conditions. If quantifiable changes in carapace shape only occur under dramatic deviations in environmental conditions or if such changes happen to be random, then any attempt to use morphometric analysis for detecting environmental fluctuations is vain.

In order to test that hypothesis, we designed an experimental test to explore the ontogenetic development of a clonal lineage of parthenogenetic ostracods (*Eucypris virens* (Jurine)) when exposed to two treatments differing in temperature by just 0.5°C (on average). The experiment result in nearly 1200 valves (left and right) whose outlines were analyzed in order to explore allometric growth under different environmental conditions. Permutation test based on within-treatment multivariate regression of the shape variables on size was used to compare ontogenetic trajectories between treatments. Additionally, the statistical approach proposed by Collyer & Adams to compare the magnitude of phenotypic change and its direction in phenotype space across pairs of taxa was also applied to our data set. Quite unexpectedly —due to the subtle differences in temperature involved between treatments— results were significant regardless of the statistical approach used thus revealing the potential of ostracod carapace shape change to track environmental changes.

# Recent ostracod assemblages from the eastern Algarve continental shelf, Portugal

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Recent marine ostracod assemblages from surface sediments of the eastern continental shelf of Algarve, South Portugal, were studied. Sixteen samples were collected in June (spring conditions) and September 2014 (summer conditions), off Armona (east of Faro) at depths between 14 and 64 m, covering the inner and the middle shelf. Around 4000 specimens distributed in more than 90 marine species were counted and identified. Several species display a few living individuals, the most important being *Basslerites teres*, *Loculicytheretta pavonia*, *Pontocythere elongata, Urocythereis britannica.*

Cluster analysis (mode Q) shows two groups of samples: A – from 14 to 20 m depth; B – from 39 to 64 m depth, which may be separated into the subgroups B1 (-39 to -44 m) and B2 (-62 to -64 m). A complementary canonical correspondence analysis clearly correlates the ostracod assemblages of these three groups with "depth" and sediment grain-size:

Assemblage A, from -14 to -20 m, characterised by coarser sediments (Ø >63 µm ranges from 94 to 98%), is largely dominated by the coastal species *Urocythereis britannica* (>55%) followed by *Pontocythere elongata*, *Loxoconcha rhomboidea*, *Aurila convexa* and *Loculicytheretta pavonia*;

Assemblage B1, from -39 to -44 m, characterised by muddy sands (Ø >63 µm ranges from 25 to 43%), represents the transition from the inner to the middle shelf, where *Urocythereis britannica* (30%) still dominates, followed by *Costa runcinata*, *Loxoconcha rhomboidea* and *Palmoconcha guttata* although *Basslerites teres*, *Callistocythere curryi* and *Semicytherura acuticostata* are also well represented;

Assemblage B2, from -62 to -64 m, corresponds to the finer sediments (Ø >63 µm ranges from 12 to 16%) and is dominated by *Costa runcinata* and *Palmoconcha guttata* (both with higher percentages than in B1), *Cytheropteron* cf. *ruggierii* and *Urocythereis britannica* (<18%).

The presence of several Mediterranean species in the eastern Algarve inner and middle continental shelf must be stressed, namely *Loculicytheretta pavonia*, *Cytheropteron* cf. *ruggierii*, *Cytheridea neapolitana* and *Callistocythere* spp.

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# Ostracod biostratigraphy of the Toarcian (Lower Jurassic) GSSP, Peniche, Portugal

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The Pliensbachian-Toarcian stage transition, especially the Lower Toarcian Oceanic Anoxic Event (T-OAE, at ~183 Ma), is currently the subject of intensive international investigation. The Toarcian Global Boundary Stratotype Section and Point (GSSP) at Peniche, western Portugal, was defined in an open marine marl-limestone series. The ostracods from this GSSP demonstrate major faunal turnover: in the *polymorphum* Biozone diversity was relatively high with at least 27 species from which nine belong to the Metacopina, but in the Oxygen Minimum Zone (OMZ; lower *levisoni* Biozone) diversity was drastically reduced to 7 species and then to 1-4; higher in the *levisoni* Biozone (post-OMZ) diversity remained low with 1 'survivor' species, 1 'lazarus' species and five new species (three belonging to the genus *Bairdiacypris* Bradfield). In the OMZ two species are most common: *Liasina lanceolata* (Apostolescu) and *Cytherella toarcensis* Bizon, the latter occurring only in the low oxygen zone. Metacopina species showed a stepwise extinction pattern and all disappeared before the *polymorphum-levisoni* biozonal boundary prior to the onset of OMZ conditions. This faunal turnover pattern is discussed in its regional and global contexts.

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## On two types of taxonomic chimaeras within ostracod systematics

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Recent efforts to make Ostracoda taxonomy more accessible is an important aspect of the modern ostracodological research. One procedure that contributes to this goal is Taxonomic Harmonisation. Another is the suppression of Taxonomic Artefacts. The communication deals with two types of Taxonomic Artefacts representing examples of so-called *Taxonomic Chimaeras.* These latter are taxa defined by amalgamation of morphological traits belonging to different taxonomic units. Taxonomic Chimera of Type 1 (*s. str.*) is represented by species defined with morphological traits belonging to different taxa. Two examples are presented. In the first one it is shown that *Loxoconcha dimorpha* Hartmann, 1959 was described using specimens belonging to two different species. The next case deals with the biased way Bronshtein (1947) described *Fabaeformiscandona balatonica* (Daday, 1894), using beside one trait typical for this species a series of morphological characters which defines *Fabaeformiscandona levanderi* (Hirschmann, 1912). Taxonomic Chimera of Type 2 refers to a genus defined with morphological elements belonging to juvenile post-embryonic stages of species classified in different genera. The case of the genus *Candoniella* Schneider, 1956 is presented. In a final discussion it is emphasised the need for an improvement of ostracod taxonomy using careful examination of original taxonomic information and its replacement within the up-today scientific context.

**Reference**

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## New insights into the rise of Meso-Cenozoic marine ostracods

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In marine environments, ostracods have been severely affected by the end-Permian extinction, about 252 Ma, and it is considered that this crisis prompted a deep restructuration of their assemblages: the transition from the Palaeozoic Fauna, dominated by Palaeocopida, to the Meso–Cenozoic or 'Modern' Fauna, dominated by Cytheroidea until today. However, this shift becomes observable only at the very end of the Late Triassic and mainly in the Jurassic, so that Triassic marine assemblages can be considered neither really Palaeozoic anymore, nor truly 'Modern' yet. The Triassic period, therefore, appears as a pivotal interval in the understanding of this event that restructured all marine ecosystems in the long term.

During the Early Triassic, marine ostracod assemblages consisted mainly of survivors of the end-Permian extinction. The Middle and Late Triassic taxa have been extensively studied during the 1970's and 1980's, and most of our knowledge on these assemblages, as well as on the Jurassic ones, derives from European localities: it is thus often considered that the radiative evolution of Modern ostracods took place in the western Tethys. However, new data challenge this paradigm. A Carnian assemblage (Late Triassic of Turkey) provides the oldest evidence of drilling predation on an ostracod: this observation not only confirms the purely Mesozoic aspect of this ecosystem, but also the establishment of drilling predation on ostracods as early as Carnian. Another assemblage from South China evidences the oldest records of species of *Carinobairdia*, known to be typical of the Norian–Rhaetian interval of the western Tethys, and species of the family Schulerideidae, characteristic of the European marine Jurassic. These observations are the very first tangible evidences of the hypothesis already being proposed in the 1980's that the eastern portion of the Tethys might have played a major role in the radiation of 'Modern' marine ostracods during the Triassic, which then might have colonized the western Tethys owing to the Late Triassic transgression.

## New results on the ostracod fauna from the Aalenian and Lower Bajocian of SW Germany

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The investigation of three sections in the Swabian Alb yielded a total of 134 marine ostracod species ranging from the Lower Aalenian to the Lowermost Bajocian. Based on their vertical distribution we named 5 microfaunal assemblages in the Aalenian and confirmed and renamed the 5 microfaunal horizons in the uppermost Aalenian and Lower Bajocian as previously established by Ohmert (2004).
The assemblages are (in chronological order):
Lower Aalenian
Opalinum zone, Aphelocythere kuhni Ostracod zone
- *Aphelocythere pygmaea – Acrocythere pumila assemblage*

Comptum zone, [Camptocythere modesta Ostracod zone]*
- *Foveolata prima assemblage*

Upper Aalenian
Bradfordensis-Zone, Gigantea-Subzone, [Camptocythere obtusa – ? C. media Ostracod zone]*
- *Pleurocythere ohmerti – Procytheropteron catena assemblage*

Upper Aalenian/Lower Bajocian
Concavum- to Discites zone, Camptocythere pusilla Ostracod zone
- *? Homocytheridea punctulata assemblage*

The microfaunal horizons h 1 – h 5 (Upper Aalenian–Lower Bajocian) plus the *stephanodes* horizon (Ohmert 2004) are formally renamed:
- *ohmerti* horizon, Pusilla Ostracod zone, Levata Subzone
- *stephanodes* horizon, Pusilla Ostracod Zone, Levata Subzone
- cf. *cadomensis* horizon, Triangula Ostracod Zone, Triangulata Subzone
- *triangula* horizon, Triangula Ostracod Zone, Triangulata Subzone
- *bicostata* horizon, Triangula Ostracod Zone, Bicostata Subzone
- *costata* horizon, Triangula Ostracod Zone, Bicostata Subzone

The following new species are described (in order of appearance):
Lower Aalenian: *Aphelocythere dilgeri*, *Cardobairdia tesakovae*, *Infracytheropteron bisulcatum*
Upper Aalenian: *Pleurocythere ohmerti*, *Procytheropteron catena*, *Cytheropterina alacostata*, *Progonocythere scutula, Kinkelinella geisingensis*, *Polycope circulosa*, *Praeschuleridea concentrica*
Lower Bajocian: *Cytheropterina bicuneata* (Braun)

13 presumably new species of Cytherurids, 1 "*Monoceratina*" sp. and 1 *Kinkelinella* sp. as well as 6 specimens 'incertae sedis' are figured, but left in open nomenclature. The ostracod fauna studied shows closer relationships to Northern Switzerland, but only restricted relationships to Northern Germany, England and France.

** not proven in our study*

**References**

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**Holocene Ostracoda (Crustacea) from the Baćina lakes (Dalmatia, Croatia)**

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The Baćina Lakes are located in Dalmatia close to the Adriatic Sea coast near the town of Ploče. They are composed of seven karstic lakes: Crniševo, Očuša, Podgora, Vrbnik, Sladinac, Vitanj and Plitko, with a total area of 1.4 $km^2$. The lakes fill a string of cryptodepressions of irregular form, and represent an interesting phenomenon in the karst. Within their zone there are several springs, tunnel which drives water from the upper zones (constructed in 1938) and the tunnel which drains water from the lakes into the sea (constructed in 1913). Generally according to biological productivity, the Baćina Lakes are classified as mesotrophic type of lakes, and according to their thermal classification they are polymictic. Only the deepest Lake Crniševo is influenced by brackish waters from the Mindel spring as well as sea water which enter the lake through a sinkhole at the bottom, especially during dry periods of the year (Ilijanić *et al*. 2015; Miko *et al*. 2015).

The present investigation is a part of the Lost Lake Landscapes of the Eastern Adriatic Shelf (LoLADRIA) project. The LoLADRIA project represents a multidisciplinary, effort to recover, for the first time, long paleoenvironmental, and paleoclimate records from existing coastal karst lakes and submerged karstic lakes of the eastern Adriatic shelf in Croatia. Preliminary results of multi-disciplinary investigation of sediment cores recovered from the lakes provides information about the Late Glacial and Holocene history of the lakes and related changes in the catchment area. In our work we will present ostracod assemblages from a core Baj-1 of lake Podgora; a core Baj-5 of lake Sladinac; and core Baj-7 of lake Crniševo.

Identified fossil ostracods in most of them coincide in all three cores. We identified a diverse ostracod fauna within three cores including 12 species that are referable to four families: *Darwinula stevensoni* of the family Darwinulidae; *Candona paionica*, *Candona* cf. *ovalis*, *Candona meridionalis*, *Candona* cf. *expansa, Candona* ex. gr. *neglecta*, *Candona* cf. *goricensis*, *Candona* sp., *Pseudocandona compressa*, *Cypria ophtalmica* of the family Candonidae; *Ilyocypris bradyi* of the family Ilyocyprididae; and *Potamocypris* sp. of the family Cyprididae. Most of ostracod species belong to the family Candonidae. Identified candonids from Baćina Lakes relate best to the known candonids from Lakes Ohrid, Prespa and Shkodra, all from the Balkan Peninsula. Identified ostracod species provide insight into the changes in the hydrology of Baćina Lakes and can be utilized in the Holocene non-marine deposits as a tool to help establishing paleoenvironments.

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**Holocene sea-level changes in Hong Kong: reconstruction based on ostracod assemblages in a sediment core**

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Hong Kong is located in the South China Sea, in a tectonically stable region far from polar ice sheets, which has been considered as an ideal place for sea-level history investigation. Microfossil Ostracoda are known as sensitive indicators of water depth and abundantly occur in sediment core samples. Thus, ostracods are useful for reconstructing past sea-level changes. Here we studied the temporal changes of ostracod assemblages in a Holocene sediment core (43 m long) retrieved from southwestern Lautau Island, Hong Kong, to reconstruct Holocene sea-level changes quantitatively by using modern analog technique (MAT). Based on the ostracod assemblages and MAT results based on them, the Holocene sea-level history was reconstructed as follows. During the early Holocene (~10200 to 8500 cal. yr BP) relative sea-level rose rapidly and continuously, during the middle Holocene (~8500 to 6000 cal. yr BP) relative sea-level continued to rise from -42.5 m to the highstand, a few meters higher than the present level, and during the late Holocene (~6000 cal. yr BP to present) sea-level gradually fell to the present level. Full results of ostracod assemblages and sea-level changes will be discussed in the presentation.

# Towards a Holarctic view of living non-marine ostracod distribution: taxonomic harmonisation of databases

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Nonmarine ostracod datasets being prepared for open access community databases such as Neotoma (www.neotomadb.org) and BioFresh (http://data.freshwaterbiodiversity.eu/) offer new opportunities in ostracod biogeography and palaeoclimatic reconstruction. Merging large regional databases requires taxonomic harmonisation, a process of ensuring that two or more datasets use consistent, equivalent taxonomic schemes, so that a common standard taxonomy can be used. In view of the investment of time and effort necessary for full taxonomic revisions, a more pragmatic approach may be adopted in order to establish a harmonised taxonomy as a "working hypothesis" that facilitates advances in projects that need large distributional datasets. To demonstrate the value of combining data from North American, European and Asian databases, we illustrate Holarctic distributions of selected species with palaeoclimatic significance. Examination of North American records of *Fabaeformiscandona rectangulata* (Alm, 1914) at the Canadian Museum of Nature shows it to be synonymous with *Fabaeformiscandona harmsworthi* (Scott, 1899), an Arctic species with value as a cold climate indicator in Pleistocene assemblages, which can be shown to have a Holarctic, circumpolar distribution. The European Pleistocene species *Limnocythere suessenbornensis* Diebel, 1968, previously thought to be extinct, may be a synonym of *L. friabilis* Benson & MacDonald, 1963 which still lives in North America in continental climates where mean January air temperatures do not exceed -3°C; it occurs today in the Laurentian Great Lakes in association with *Fabaeformiscandona caudata* (Kaufmann, 1900) and another species with a circumpolar distribution, *Cytherissa lacustris* (Sars, 1863), an indicator of fresh, cold, well-oxygenated and permanent water bodies. North American *Pelocypris alatobulbosa* Delorme, 1970 (living) and *Ilyocypris shawneetownensis* Staplin, 1963 (Pleistocene), as well as *Ilyocypris steegeri* Kempf, 1967 (Pleistocene, Europe), have all been shown to be synonyms of *Ilyocypris salebrosa* Stepanaitys, 1960 which is now known to have a wide Holarctic distribution across Asia, Mediterranean Europe and North America. Pleistocene interglacial occurrences in Britain, where it is not now found living, are indicative of summers that were warmer than those of today (mean July air temperature of at least 17 °C).

**Benthic faunal responses to deoxygenation and Pleistocene climate events, the Sea of Japan**

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The Sea of Japan is a semi-enclosed marginal sea, connected to adjacent oceans through shallow straits (<130 m water depths). It is a key area for understanding biological impacts of deoxygenation, glacial-interglacial variability, and Pleistocene climate events. During interglacial high sea-level periods, the marginal sea was well-ventilated with the Tsushima Warm Current flowing in from the south. During glacial low sea-level periods, the water column was stratified due to surface freshening as the Tsushima Warm Current influx was weak or absent in the marginal sea. Basin-wide glacial deoxygenation events caused by strong stratification are well-known in the Sea of Japan. However, studies on the biotic responses to these events covering time periods beyond the past two glacial-interglacial cycles were rarely available. Here we present two-million-year, high-resolution records of ostracod faunal changes at the Integrated Ocean Drilling Program (IODP) Sites U1426 and U1427 in the southern Sea of Japan. Our results show that (1) recursive extirpation events were followed by alternating dominance of *Krithe* and *Cytheropteron* in the recovery stage, (2) a faunal transition from circumpolar *Acanthocythereis dunelmensis* to endemic *Robertsonites hanaii* occurred at the Mid-Brunhes Event (~0.4 Ma), and (3) benthic faunal changes are primarily controlled by the Mid-Brunhes Event and secondarily by oxygen levels. This study indicates high vulnerability of deep-sea benthic fauna to deoxygenation and sea-level changes in marginal seas. Several recent studies and our study have suggested that the Mid-Brunhes Event was a major environmental perturbation to deep-sea ecosystems in several oceans and seas.

**Taxonomy of Candoninae (Ostracoda): molecular insights into a difficult problem**

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The subfamily Candoninae is one of the most taxonomically difficult and species-rich lineages of widely distributed non-marine Ostracoda, inhabiting all kinds of surface and subterranean waters. Although this group is well documented also as fossils, and several authors have already attempted to revise phylogenetic relations within the family, its taxonomy remains unclear and generic relationships ambiguous due to a number of homoplasies. To verify the morphology-based taxonomy and monophyly of the European morphogenera of Candoninae, we propose an analysis of the nuclear fragment encoding ribosomal RNA (*28S rRNA*), the marker widely used in animal phylogenetic studies, including non-marine ostracods. We investigated 52 individuals from 23 species (including one yet undescribed) representing 7 of 13 recent genera known from Europe. Our phylogenetic analyses revealed a noteworthy incongruence with the currently used taxonomy of the morphogenus *Fabaeformiscandona*, monophyletic status of which appeared questionable, but at the same time, the monophyly of the morphogenera *Candona* and *Pseudocandona* was observed, also at the level of species groups distinguished morphologically within these genera. Based on our data representatives of the genus *Typhlocypris* clustered with the *rostrata* species group of *Pseudocandona*. Our analysis revealed a handful of salient points on Candoninae evolution and provides a baseline for further studies in which two independent genetic markers will be used to infer phylogenetic relationships within this subfamily.

**DNA barcoding reveals cryptic diversity in a non-marine ostracod morphospecies *Heterocypris salina* (Brady, 1868)**

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DNA barcoding of the cytochrome oxidase subunit I (COI) gene was used to reveal the cryptic diversity within a halophilic ostracod morphospecies *Heterocypris salina*. DNA from a total of 94 individuals from 10 all-female localities in Greece, Italy, Morocco and Poland was amplified. The final alignment consisted of 559 base pairs of the COI gene showing 166 variable and 160 parsimony informative sites. The 20 recursive steps in the Automatic Barcode Gap Discovery (ABGD) analysis resulted in four different sequence partitions, ranging from one to six preliminary species hypotheses (PSH). The best correspondence between the PSH and the constructed COI gene tree was found at the partition, in which each of the six recognized PSH corresponded well to the main lineages with high bootstrap support. Interestingly, *H. salina* from Greece (Crete) diverged from the other molecular operational taxonomic units (MOTUs), however, only one mtDNA haplotype was found in this location. On the contrary, individuals from some localities in Morocco or Poland showed high intra-site diversity resulted in recognising representatives of two or three PSH and MOTUs co-occurring at these sites. In general, comparison of pairwise haplotype distances within *H. salina* morphospecies exhibited high genetic diversity ranged from nearly 0.0% to 23.5% confirming presence of cryptic diversity. Finally, it is worthy of note, that females from most genetically variable sites displayed coherently the highest within-site phenotypic variation of the valve shape as revealed by geometric morphometrics techniques. Moreover, our analysis demonstrated also statistically significant valve shape differences in pair-wise tests between three putative cryptic species.

## Normal pore canals in ostracod taxonomy: the case of *Minyocythere*

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Sieve-type normal pore canals were (probably) first figured and discussed in fossils by Triebel (1941) in Middle Jurassic material from north-west Germany, now formally described as *Minyocythere* Lord, Cabral & Danielopol. The genus as described comprises four (?five) species: *M. macroporosa* sp. nov., *M.* cf. *macroporosa*, *M. angulata* sp. nov., *M. maculosa* (Bate, 1963) and *M. tuberculata* (Luppold, 2012). Species recognition and definition followed two independent lines of investigation: 1) classical comparison of carapace and valve characteristics of external shape, overlap, dimorphism, ornament, and internal features of hingement, muscle scar pattern and marginal zone, combined with stratigraphic occurrence (ARL, MCC); 2) analysis of normal pore canals both externally and internally via high-resolution SEM images (ARL, MCC, DLD). We discuss the results of this comparative experiment.

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## Shifts in sexual selection across the Cretaceous/Paleogene mass extinction boundary in cytheroid ostracodes

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Sexual selection is a special case of natural selection that favors investment in expensive sexual traits that help individuals compete for mates. In a rapidly changing environment, however, allocation of resources in traits related to reproduction at the expense of those related to survival may elevate extinction risk. Empirical testing on this hypothesis in the fossil record, where extinction can be directly documented, is largely lacking.

The rich fossil record of cytheroid ostracodes offers a unique study system in this context: the male shell is systematically more elongate than that of females, and thus the sexes can be distinguished, even in fossils. Using mixture models to identify sex clusters from size and shape variables derived from the digitized valve outlines of adult ostracods, we systematically estimated sexual dimorphism in ostracode populations before and after the Cretaceous-Paleogene mass extinction.

Across this boundary, we document a reduction in sexual dimorphism, driven mostly by a pronounced decline in the most extreme dimorphism styles. This shift, which seems to arise from both selective origination among taxa and evolutionary changes within taxa, parallels extinction selectivity previously documented during the late Cretaceous (background extinction regime). Our results suggest that resource allocation strategies in terms of survival versus reproductive investment may be an important factor for species survival during background and mass extinctions.

**Preservation of Ostracoda in Miocene Amber from Chiapas, Mexico, revealed by synchrotron tomography techniques**

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Ostracods found in high numbers in Mexican amber from Chiapas' Campo La Granja mines predominantly belong to the tribe Thalassocypridini (Paracypridinae, Candonidae). The amber was formed in a brackish estuarine environment with tidal marine influence and sea-level fluctuations during Lower Miocene (23 Ma). Synchrotron micro- and nanotomographic investigations of 19 ostracod specimens from Chiapas amber revealed that preservation inside the specimens is highly variable, even within a single specimen. We will present and discuss the different appearances of the valves and soft parts in x-rays, and address examples of organs that seem to have a higher probability to be preserved than other organs in amber ostracods, such as the spiral duct and the 'shell gland'. We will further discuss the relevance of these micromorphological findings for the study of the evolution of the Thalassocypridini.

**Palaeoenvironmental evolution of an active rift basin through ostracod analysis: the example of the Corinth Gulf (IODP Leg 381)**

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In complex palaeoenvironmental settings, ostracods can be particularly helpful proxies, because, unlike other commonly used micropalaeontological proxies such as foraminifera and nannoplankton, they occur in almost all aquatic environments, from deep marine to temporary freshwater.

In the Corinth Basin, cyclic variations of 10s-100s of kyr in palaeoenvironments record eustatic sea-level oscillations. During the IODP Expedition 381 "Corinth Active Rift Development" in the Gulf of Corinth three sites were drilled that provide a high-resolution record of sedimentation in the center of the Gulf of Corinth (M0079 and M0078) and in the eastern part of the gulf, in the Alkyonides Gulf (M0080). Prior micropalaeontological investigations have indicated alternation between marine and "isolated" (e.g., non-marine) environments.

Ostracods are abundant and well preserved throughout cores M0080A and M0078A, with a total of about 50 species. *Henryhowella sarsi*, *Bosquetina dentata*, *Cytheropteron* spp., *Palmoconcha* spp., *Polycope* spp. among others characterize the interglacial bathyal marine sediments representing Marine Isotope Stages (MIS) 1, 5, 7, 9 and 11. They represent the "typical" Mediterranean ostracod assemblage and the marine phases of the gulf, when the sea water was flowing from the Mediterranean through the sills of the Corinth basin. In sediments associated with glacial stages MIS 2, 4, 6, 8, and 10 a notable faunal turnover takes place. The Mediterranean ostracod assemblage is completely replaced by a brackish-water Ponto-Caspian ostracod assemblage. The dominant taxa are *Amnicythere olivia*, *Amnicythere cymbula*, *Loxoconcha lepida*, *Tyrrenocythere amnicola*, indicating environments "isolated" from the Mediterranean Sea. In fact, the Mediterranean assemblage repeats quite constantly during each interglacial phase, whereas each glacial phase is characterized by a different dominant species. These results indicate frequent and abrupt changes occurred in the Gulf of Corinth during periods of glacial inception and deglaciation. The micropalaeontological record will be used in conjunction with other studies to examine the tectonic, sedimentary and environmental history of the basin.

**The end-Ordovician "interesting times" in the ancient Baltic Palaeobasin**

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Well-documented ostracod material from deposits of the end-Ordovician climate cooling event was quantitatively analyzed for palaeocommunity dynamics across the Hirnantian "interesting times" interval in the ancient Baltic Palaeobasin that was characterized by deep sea level fall and rearrangement of both sedimentary facies and palaeocommunities. Our analyses of 143 samples from 17 localities in Estonia, Latvia, Lithuania, northern and north-eastern Poland and southern Sweden allowed to distinguish 9 marine ostracod palaeocommunities. The communities of the latest Katian, glacial Hirnantian and late Hirnantian–Silurian are very distinct, being generally characterized by decreasing Simpson's diversity both temporally and along the facies profile. The shallowest part of the palaeobasin, was occupied by the pre-glacial *Steusloffina cuneata*-*Medianella aequa* community with high Simpson's diversity (0.72–0.89). Several other contemporaneous communities of somewhat lower diversity (0.50–0.77) could be identified in other (offshore) areas of the palaeobasin. The species composition of the early (glacial) Hirnantian ostracod association of remarkably lower diversity was distinct from that of the pre-glacial communities, being dominated by binodicopes (*Harpabollia*, *Circulinella*, *Aechmina*) whilst a contemporaneous nearshore reef-related podocope-dominated ostracod community could be characterized as an impoverished pre-Hirnantian community. The appearance of the post-glacial late Hirnantian to Silurian community marks a faunal unification over the vast study area and the appearance of a community of the lowest diversity, dominated mainly by podocopes (genera *Microcheilinella* and *Longiscula*). Two Hirnantian communities are thought to be of similar age, based on stable carbon isotopic correlation, but contain only a very limited number of common species and none of the Hirnantian binodicope immigrant genera reached the nearshore zone.

## New method of describing smooth ostracod shells

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The vast majority of Permian and Triassic freshwater ostracods of the East European Platform had smooth shells. Details of the outline of the shell from the lateral and dorsal side were commonly used as species features. However, until now no standardized terminology is available for describing the outline in detail. The lack of a unified terminology makes it very difficult to diagnose and compare species of smooth ostracods. The new method allows better characterize the outlines of the shell using a small number of terms. It is based on the following algorithm:

1. Ostracod shells are photographed in lateral and dorsal projections.
2. The resulting images are oriented in a special way. Images of the shell in the lateral view are oriented in three different ways, depending on the shape of the ventral margin: (1) when the ventral margin is concave the image is oriented so that the two points of maximal curvature (PMC) are located on the basal line; (2) when the ventral margin is straight the line of the ventral margin is aligned on the basal line; (3) when the ventral margin is convex, PMC of the anterior and posterior ends are connected by a straight line, which is oriented parallel to the basal line. The image of the shell in the dorsal view is oriented similarly to the last version.
3. The oriented image fits into the rectangle so that the sides of the rectangle are tangent to the shell margins; the point or points of PMC of each of the margins are indicated at the point of tangency.
4. PMCs connect in pairs: PMC of dorsal margin connects with PMC of anterior and posterior margins and PMC of ventral margin also. Thus, the shell outline is divided into 4 curves, each of which is inscribed in the right triangle. The outline of shells with a concave or straight ventral margin is divided into 5 curves, one of which corresponds to the ventral margin and is described separately.
5. The curve inscribed in a triangle is described by three parameters: the type of the curve, the degree of convexity of the curve, and the position of the PMC of the curve. The type of the curve is determined by the ratio triangle catheti: when catheti is equal, the curve will be called *normal*; when a horizontal cathetus is larger than vertical, curve will be called a *horizontal*; otherwise, curve will be called a *vertical*. The degree of the curve convexity is determined by the ratio of the segments drawn from the right angle of the triangle to the PMC of the curve and through the PMC to the hypotenuse. Three categories of curves for this feature are distinguished: 1) *steep* with the ratio of 0-0.35, 2) *moderate* with the ratio of 0.35-0.7, and 3) *sloping* with the ratio of 0.7-1. The position of the PMC of curve is determined by the angle between the horizontal cathetus and the line drawn through PMC. The larger this angle, the more PMC is shifted towards the end of the shell. There are 3 types of curves for the angle: 1) 0-30° - *proximal*; 2) 30-60° - *medial*; 3) 60-90° - *distal*.

Thus, it is possible to accurately characterize each of the curves that make up the ostracod shell outline using three terms. The method is called the method of right triangles.

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**Co-habiting non-marine ostracods harbor host-specific microbiota**

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Although recent discoveries indicate that aquatic invertebrates could host specific communities of microbiota, it is still unknown if this specificity is driven by environmental or host-derived factors, in particular in species inhabiting temporary wetlands and displaying obligate diapause. In this work, we present the first comprehensive analysis of taxonomic composition of microbiota associated with two non-marine ostracods *Sclerocypris tuberculata* and *Potamocypris mastigophora* raised from resting eggs and co-cultured in laboratory conditions. We showed that composition of bacterial communities was stable and non-random over the period of experiment. Detailed analysis of 16S rDNA sequences revealed that despite sharing the same environment, each ostracod species developed distinct bacterial communities. The major difference was caused by the dominance of the family *Comamonadaceae* (*Betaproteobacteria*) in *Potamocypris mastigophora* and the *Aeromonadaceae* (*Gammaproteobacteria*) in *Sclerocypris tuberculata*. Furthermore, prediction of metabolic pathways in metagenomes, demonstrated that bacteria of *Potamocypris mastigophora* exhibit higher number of sequences associated with the membrane transport and xenobiotics biodegradation and metabolism. Our study not only provided an insight into microbiota of non-marine ostracods but also showed that different ostracod species are hosts for functionally distinct and ecologically important bacterial communities.

## Silurian myodocope ostracods from Poland

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Newly collected material reveals that the Silurian myodocope ostracods from the Holy Cross Mountains, Poland comprise ten species (including one new to science) belonging to four families: Bolbozoidae, Entomozoidae, Rhomboentomozoidae, and Cypridinidae. Biostratigraphic control using graptolites indicates that all three Polish outcrops investigated are of about the same biostratigraphical age: middle Gorstian (lower Ludlow). The new occurrences in Poland extend the known distribution of several species and reinforce data that show many Silurian myodocope species with wide dispersal. Our new observations on the Holy Cross Mountains confirm that the occurrences of Silurian myodocopes are mostly associated with pelagic animals and with rocks ranging from mudstone, siltstone or shale deposited in open- or deep-shelf marine settings. The cosmopolitan distribution of these ostracods, coupled with their facies and faunal associations, supports the notion of a myodocope ecological shift from benthic to planktonic habitats during the late Wenlock and Ludlow.

**Ostracod investigations as part of multiproxy analyses - case studies from two ancient harbours**

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The complete understanding of human and landscape history and their complex interactions is a highly topical desideratum of modern science in general, and, in particular, of landscape archaeology and geoarchaeology. A variety of specialized scientific disciplines focuses on the investigation of different aspects of past societies and palaeo-environmental changes and conditions. However, in order to gain as comprehensive a picture as possible, all disciplines have to work together and couple their broad range of methods and approaches. The number of applied methods is high and includes, among others, approaches involving sedimentology, geomorphology, archaeology, soil sciences, advanced statistics, remote sensing (geoinformation systems), geophysics, and, last but not least, micropalaeontology. We present two examples from the Aegean Turkish coast where ostracods play an important role in palaeoenvironmental reconstructions which represent both natural environmental evolution and human impact and its interaction. The complexity of the coastline is of crucial importance for the existence of harbours. On the west coast of Turkey, the well protected and deeply incised embayments provided ideal locations for harbours during antiquity. Their connection to the hinterland *via* rivers made these locations even more attractive. However, the enormous fluvial sediment supply led to the siltation of the harbours in relatively short times. Concerning the microfossil inventory, harbours are very similar to lagoons in habitat type and ecology due to their protected position. In harbour basins, eutrophication is common, caused by the input of human waste and the reduced exchange of water. This is reflected by a ubiquitous faunal association, including *Cyprideis torosa* and *Loxoconcha elliptica*, adapted to temporary deficiency in oxygen. Often, the sedimentation rate is higher than in natural lagoons. Silting up of a harbour leads to the separation from the sea followed by a freshening of the water body with a characteristic freshwater fauna during the final phase. This marked change in the faunal composition including the freshwater species *Candona neglecta, Ilyocypris bradyi,* and *Heterocypris salina*, indicates the disconnection from the sea and the end of the harbour activity. In this study we compare the Roman Harbour of Ephesos and the Hellenistic Harbour of Elaia regarding ostracod and foraminifer distribution, sedimentation processes, landscape evolution and human impact. The key difference between the two harbour sites is the various sedimentation rates. In Elaia the sedimentation rate was low that caused the present position of the harbour close to the coast, whereas Ephesos was subject of a very high sementation rate causing rapid siltation and separation of the Roman Harbour from the sea.

# Taxonomy, biostratigraphy and palaeoecology of Early Cretaceous non-marine ostracods in Luanping Basin of northern Hebei, North China

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The Jehol Biota represented a diverse ecosystem in the Cretaceous world, particularly with respect to the high diversity and abundance of fossil species, and provides critical evidence for understanding the evolution of Early Cretaceous terrestrial (non-marine) ecosystems. The study of the Jehol Biota has mainly focused on the Yixian and Jiufotang formations of Western Liaoning, China, which represent the middle and late stage of this biota. The early Jehol Biota and its relevant strata, however, remain to be studied further. The Luanping Basin and other basins in the northern Hebei Province, China, preserve abundant fossils of the early Jehol Biota, including non-marine ostracods. Detailed field work on representative sections of the Lower Cretaceous Dabeigou, Dadianzi and Xiguayuan formations of the Luanping Basin have revealed a diverse ostracod fauna with ostracods occurring frequently in the sections and in high abundance. Previous taxonomical and biostratigraphical analyses of the ostracods contribute to the improved age assignment and correlation of respective formations, the correlation with the relevant stage of the Jehol Biota, and on the controversy on the position of the J-K boundary in the Luanping basin and adjacent basins (e.g., Qin *et al*. 2018). These studies demonstrated the need for more detailed work and thorough taxonomical revision of the ostracod fauna and its biostratigraphical and paleoenvironmental utility.

In an ongoing PhD project, detailed studies on relevant sections of the Dabeigou (Yushuxia section), Dadianzi (Shangying-Xiaying section), and Dadianzi or Xiguayuan (Liying section) formations of the Luanping Basin are carried out, including high-resolution measuring and sampling for microfossils as well as detailed sedimentological descriptions to establish the lithostratigraphic framework. Preliminary taxonomic analysis revealed (depending on sections and formations) 7–13 genera, including *Cypridea*, *Yumenia*, *Daurina*, *Yanshanina*, *Ocrocypris*, *Eoparacypris*, *Djungarica*, *Darwinula*, *Alicenula*, *Rhinocypris*, *Timiriasevia*, *Lycopterocypris* and *Mongolianella*, and around 40 species of non-marine ostracods. Field work on the Lower Cretaceous interval of the Liying section, the stratigraphical assignment of which either to the Dadianzi or the Xiguayuan Formation is still debated, revealed abundant fossils of gastropods, bivalves, ostracods, spinicaudatans, fishes, shrimps and plants. Based on biostratigraphic correlations of the Dadianzi Formation to stratigraphically equivalent formations of adjacent basins, it is concluded that the earliest occurrence of *Cypridea*-species in the northern Hebei–western Liaoning area, North China, is ~130 Ma (lowermost Barremian).

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**The impact of the Mulde bioevent (Lower Silurian) on Ostracod ecological dynamics**

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The Mulde Bioevent (428 million years ago) was one of the most important geobiological events which affected biota during the dynamic Silurian Period. At that time, most of the graptolites went extinct. However, so far, it is not much known about the impact of this event on the benthic biota.

Ostracods are an important component of benthic ommunities and ostracods of the Silurian Period are insufficiently investigated on the global scale. The purpose of this work is to research the impact of the Mulde mass extinction (Early Silurian) on ostracode ecological dynamics.

In order to achive this goal, detailed sampling of the Gėluva-118 core was performed, with later processing of samples and extraction of ostracod shells. Additionally, their taxonomic identification and statistical analyses of diversity in the rock samples were accomplished. 99 samples (in 952,1–1049 m depth interval) spanning approximately two million years were taken, starting from the pre-extinction phase and the onset of the Mulde Bioevent at the beggining of the Gėluva Age up to the full recovery. For the purpose of chemostratigraphy, $\delta^{18}O$ and $\delta^{13}C$ analysis was performed.

The results of this study show the increase of ostracod quantities and intraspecific variability immediately after the end of the Mulde Bioevent. This perturbation could be related with a rise in the sea level, as the maximum ostracode abundance was reached at the maximum sea level. Rarefaction curves with diferent sample size census show a general tendency of rising diversity. New results from ostracod studies show that the upper Wenlock is characterized by the decline of dominance and increase in entropy and species evenness. Probably one of the most important factors driving biodiversity and abundance change during the studied time interval was eustatic sea level change.

# The Central Tunisian Atlas as a biogeographic crossroad: Insights from a potential key area for mid-late Mesozoic non-marine ostracod and charophyte research

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Ostracods and charophytes are among (if not *the*) most useful groups for biostratigraphical and palaeoenvironmental application in mid–late Mesozoic non-marine successions. During the last few decades, we have started to overcome problems hampering their practical implementation in supra-regional biostratigraphy (Sames & Horne 2012). Modern insights into non-marine ostracod and charophyte palaeobiology and palaeobiogeography and new data have expedited the process of taxonomic revision and facilitated new approaches and tests for hypotheses of supra-regional to global distribution and biostratigraphical application.

In Tunisia, Mesozoic non-marine to marine transitions and respective successions are known from the Central Tunisian Atlas (CTA) and the Tunisian Saharan Platform (TSP), north Gondwana, southern Tethys margin. During the Middle Jurassic to mid-Cretaceous transgressions and regressions onto the essentially stable Saharan Platform and coeval tectonics produced a complex pattern of basins and islands. In the context of a successful collaboration project between Tunisian and Austrian researchers we especially focus on non-marine Ostracoda and Charophyta as well as the characterization, refined stratigraphy, and evolution of mid-late Mesozoic lake-systems and their deposits in the CTA and TSP, the controlling factors and their regional to supra-regional biostratigraphical context.

Tunisian Mid-Jurassic to mid-Cretaceous marine to non-marine deposits reveal partially new, rich ostracod faunas and charophyte floras, many elements of which can be supra-regionally linked to Gondwana, i.e., West Africa and South America, and Eurasia plus partially North America (e.g. Trabelsi *et al*. 2015). This is a result of the same dispersal strategies and mechanisms of certain non-marine ostracod groups and charophytes, i.e., they are passively transported by larger animals over short and long distances – crossing migration barriers, even oceans. Our new discoveries not only improve the regional biostratigraphy but also facilitate supra-regional correlations in this time interval and support concrete considerations of non-marine faunal and floral exchanges between South America and Asia via North Africa and the Peri-Tethyan islands, for example. Considering varying dispersal vectors coming into question at different respective time intervals (e.g. evolution of birds) in the context of contemporaneous palaeogeographical patterns and changes, and palaeoclimate, the CTA and TSP are becoming key areas of interest for mid-late Mesozoic non-marine (micro-)palaeontological research and application. Our new data corroborate the fundamental utility of non-marine Ostracoda and Charophyta as powerful chronostratigraphic tools.

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**Colonization on the rooftop of 'Bunker Valentin' in Bremen, Germany by Ostracoda and Cladocera (Crustacea)**

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The "Bunker Valentin" in Bremen was a heavily fortified submarine factory during the Second World War. The protective shelter was attacked and made unusable in March 1945 in a bombardment including 10,000 kg bombs. Over 70 bomb craters of various sizes are left on the massive concrete roof of the bunker (20,000 $m^2$), of which some hold meteoric water to various degree. Between 2013 and 2015, a set of pools permanently and temporarily bearing water were sampled and 14 ostracod and 7 cladoceran species were identified. The two permanent pools held the highest species diversity, while the number of ostracod species varied distinctly in the temporary pools. A comparative study after the meteorological dry summer in 2018 revealed a dramatic loss of suitable habitats, but also raised questions about the dispersal ability and survival strategies of microcrustaceans in isolated pools.

## Male-driven evolution in the ostracod genus *Lophocythere* from the Middle Jurassic of the Russian Plate

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Phenotypic evolutionary transformations of organisms commonly begin with ontogenetic changes, in particular due to heterochrony through paedomorphosis or peramorphosis (Gould 1977, McNamara 2012, Ozawa 2013). However, evolutionary rates in males and females of the same species can vary (Geodakyan 1965, McNamara 2012). It has been shown, that within the same extant and extinct Quaternary ostracod species of the family Loxoconchidae from Japan, it is the males that got evolutionary changes first: the hinge of male carapaces is differentiated from that of females due to paedomorphosis (Kamiya 1992, Ozawa 2013). We have observed a similar phenomenon in carapaces of Jurassic ostracods of the genus *Lophocythere* Sylv.-Bradl., 1948 from the upper Callovian of the Russian Plate including four species – *L. karpinskyi* (Mand. in Lyub., 1955), *Lophocythere* sp. A, *Lophocythere* sp. B and *L. acrolophos* (What., Ball., Arm., 2001). They belong to three different morphogenetic lineages: *L. karpinskyi* → *Lophocythere* sp. A, *L. propinqua* Malz, 1975 → *L. scabra* Triebel, 1951 → *Lophocythere* sp. B and *L. interrupta* Triebel, 1951 → *Lophocythere acrolophos* (Schurupova & Tesakova, 2019, in press.). The fossil material from the Mikhailovtsement section (Ryazan region, Russia, $J_2cl_3$) allowed us to study the ontogeny of three species: *L. acrolophos* (71 specimens), *L. karpinskyi* (51 specimens) and *Lophocythere* sp. A. (201 specimens). During their ontogeny, these species underwent changes in the carapace length/height ratio, sculpture, and hinge structure. The sexual dimorphism appeared at the last (9th, mature) moult stage. In addition, *L. acrolophos* only displayed sexual dimorphism in the hinge structure. It is noteworthy that in *L. acrolophos* the hinge structure is identical in both males and females during the 1st to 6th ontogenic stages (moults) but starting from the 7th–8th moults, so-called precocious sexual dimorphism (Whatley & Stevens 1978) is recognizable. This phenomenon was displayed by the preservation of juvenile features on the male hinge, thus, by paedomorphosis.

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**A new non-marine ostracod fauna from Pleistocene sediments (MIS11) at Little Cornard, Suffolk, UK**

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A cliff left by excavations for brick making in the former pit at Little Cornard exposes calcareous deposits approximately 3 m thick. These pale yellow and white calcareous sediments are mostly bedded with cm-scale laminations but include a massive white unit displaying vertical traces interpreted as plant stems or roots. This deposit was once thought to represent a "remanié Chalk" but was subsequently interpreted as a calcareous tufa intercalated with lacustrine laminated clays and silts, overlying chalky sands and gravels of glacial origin (BGS Memoir). Previous work recorded freshwater molluscs but ostracods were hitherto unknown at this site. Sampling of the exposed section yielded abundant, well-preserved ostracods representing 18 species and 9 genera. Identifications are preliminary and some are left in open nomenclature, but the assemblage is clearly indicative of non-marine waters and includes two species of *Fabaeformiscandona*, *F. clivosa* (Fuhrmann, 1991) and *F. compendiosa* (Fuhrmann, 1991), that have not previously been recorded in the British Pleistocene, as well as *Ilyocypris bradyi*, *I. quinculminata*, *Paralimnocythere bicornis*, *Cypridopsis vidua*, *Pseudocandona marchica*, *Ps. compressa, Limnocythere sanctipatricii*, *Sarscypridopsis aculeata* and species of *Cyclocypris* and *Herpetocypris.* The presence of *I. quinculminata* is consistent with a supposed MIS11 age based on the geological context (the deposits lies above a till of the Anglian glaciation (MIS12)) as this species does not occur in deposits younger than MIS11. The combined assemblage from all samples bears a strong resemblance to the Holsteinian Interglacial fauna of Wildschütz (Saxony, Germany) documented by Fuhrmann (1991). We will discuss the taxonomy, taphonomy, stratigraphical variation and palaeoenvironmental interpretation of the ostracod fauna, and consider its palaeoclimatic implications. The assemblages appear to be freshwater but the occurrence of *S. aculeata* hints at some saline influence and we will evaluate the likelihood that the site was close to the North Sea coast during MIS 11 warm intervals with high sea levels (the Hoxnian Interglacial and subsequent interstadials).

## The Pannonian ostracod fauna from the Zalanyi's type section of Obrenovac (Serbia)

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It is known that an accurate taxonomy of any group of organisms is fundamental for their use in biostratigraphical, paleoecological, paleoenvironmental or paleoclimatological studies. The studies of the caspibrackish ostracods distributed in the Neogene of the Paratethyan domain started in 1850 by Reuss, and were followed by several Hungarian and "Soviet" palaeontologists that in around one century established more than 200 new species. Unfortunately, due to the old age of those papers and to the often missing or incomplete original collections that suffered at least two World Wars, the taxonomy of the majority of them is confused.

A monograph published in 1929 by Zalányi (Zalányi 1929) represents a milestone for the studies on Paratethyan ostracods. As a consequence, its original collection stored in the Magyar Bányászati és Földtani Szolgálat at Budapest (Mining and Geological Survey of Hungary) was revised by Sokač & Gagić (1968) and Krstić (1971), and more recently by us (Spadi *et al*. 2019). Unfortunately, the collection was incomplete and to fill the gap we resampled the Zalanyi's original site of Obrenovac, along the Kolubara River, central Serbia. The studied Obrenovac composite section (44°36'47''N, 20°12'36''E; thickness: 10 m) is mainly made of blue, brown, and grey silts that pass upwards to sands rich in mollusc debris. The ostracod fauna consists of 27 species, including 17 taxa that were listed or described by Zalányi (1929). Among them, *Bakunella dorsoarcuata* and *Zalanyiella venusta* remains represent new topotypic material within which neotypes have been designated.

Re-descriptions and taxonomical revision have been performed on the whole collected ostracod fauna including species of *Euxinocythere*, *Amnicythere*, *Loxocauda*, *Loxoconcha*, *Hemicytheria*, *Cyprideis*, *Bakunella*, *Camptocypria*, *Caspiocypris*, *Fabaeformiscandona*, *Hastacandona*, *Lineocypris*, *Pontoniella*, *Typhlocyprella*, *Typhlocypris*, *Zalanyiella*, *Cypria*, and *Amplocypris*.

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**Deglacial-Holocene Svalbard paleoceanography and evidence of Melt Water Pulse 1B**

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Understanding deglacial melt water pulses (MWPs) is important for us to meet future challenges of global warming and rapid sea level rise. However, the second largest MWP, 1B, reconstructed from far-field records has been continuously debated on its timing, magnitude and even existence. Here we report near-field evidence of MWP-1B from two marine sediment cores JM10-10 GC and JM10-12 GC from Storfjorden, Svalbard. The two cores are studied for their ostracod fauna to reconstruct deglacial-Holocene history of sea level, salinity and temperature changes and MWP-1B is clearly indicated by three-stage faunal succession during circa 11.3–11.0 ka BP. In the glaciomarine sediments at the bottom of the cores of >11.3 ka, cold deep-sea species were predominant with a minor occurrence of glaciomarine shallow-marine transported species. Disappearance of the cold deep-sea assemblage and subsequent emergence of a warm deep-sea assemblage after 11.3 ka BP indicate intrusion of warm Atlantic water into Storfjorden. Then, the warm deep-sea assemblage thrived only for <500 years before it was replaced by a shallow-marine euryhaline assemblage, which shows depositional environmental change from continental slope to continental shelf. This faunal turnover represents MWP-1B with melting of Eurasian ice sheet and resulting isostatic rebound. Semi-quantitative analysis of water depth ranges of ostracod species indicates water depth drop by approximately 40 m at the time of MWP-1B. Contaminant changes in temperature and salinity due to cold meltwater discharge are also observed. During mid to late Holocene, shallow-marine euryhaline species dominated. A relatively deep and cold assemblage replaced these euryhaline species after ~2 ka BP. Our reconstruction of deglacial-Holocene near-field sea level and key environmental factors is overall consistent with other paleoceanographic studies in the region. More importantly, the detailed process of MWP-1B including initial warming, melting of large ice sheet and resulting isostatic uplift is clearly reflected by ostracod faunal succession.

## How do cryptic species look like in the fossil record?

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Recent molecular studies suggest that we have a higher species diversity than identification efforts relying solely on morphological traits. Thus, the fossil morphospecies identified in geo-archives hold a higher species diversity, too. However, (re-)evaluating morphological traits and/or ecological response in extant taxa may result in a taxonomy/nomenclature that mirrors the molecular diversity better.

Here we studied the morpho-variable ostracod species *Eucypris virens* (Jurine, 1820) and used high-resolution µ-CT scans for an objective geometric morphometric approach using 3D curve and surface-sliding semi-landmarks. The morphological results were compared to genetic clades of *Eucypris virens* by multivariate statistics. We could show that at least three previously considered cryptic species are morphologically distinguishable. The use of software and statistics applied in (palaeo-)anthropology on feature-poor non-marine ostracod shells demonstrates the importance of interdisciplinary collaboration in the development of new methods for quantifying morphology. Based on this work and the genetic results of previous studies, a revision of the *Eucypris virens* species complex is strongly recommended.

**Environmental stability of Western Carpathian spring-fens and its influence on Ostracod assemblages**

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Western Carpathian spring fens are unique biotopes hosting a high diversity of various groups of organisms. These groundwater dependent systems are considered as relatively stable environment, however, possible temporal fluctuations in environmental conditions have not been sufficiently studied. In this study we have evaluated the environmental stability, i.e. water and temperature regime, at 34 spring fens and its influence on ostracod assemblages, while controlling for effects of other significant environmental variables and spatial structure. Altogether 20 ostracod taxa were found during one shot sampling in June 2008, 2011 and 2012. Water temperature was recorded every 30 min for 24 months and water levels were measured manually six times (April 2016 to April 2018).

The spring fens showed two independent gradients of environmental stability: in water temperature (i.e., mean July water temperature) and groundwater level fluctuations. Water temperature amplitude ranged from 4.3 to 17.3°C and groundwater level fluctuation ranged from 0 to 9.5 cm. Groundwater level fluctuation was the most significant variable driving the spring fen ostracod assemblages. Its effect was only partly shared with Ca+Mg content and spatial structure, which were also significant. However, ostracods showed no response to the gradient in water temperature, in contrast to another microcrustacean group, harpacticoids, co-occurring at the same sites, which were strongly dependent on the thermal regime. We suggest that ostracod species with affinity to spring environment are not necessarily cold stenothermal and to a certain degree they can tolerate fluctuations in water temperature.

**Biostratigraphic and palaeoenvironmental significance of Campanian-early Maastrichtian (Late Cretaceous) ostracods from the Jiaozhou Formation of Zhucheng, Shandong, China**

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Cretaceous strata are well developed in the Jiaolai Basin (Jiaodong Peninsula, East China) and contain abundant fossils including hadrosaurids, tyrannosauroids, various types of dinosaur eggs, bivalves, gastropods, ostracods, clam shrimps, insects and plants. During a geological investigation in Zhucheng City, eastern Shandong Province, East China, a new exposure of part of the Jiaozhou Formation was discovered near Jiankou Village. This formation constitutes uppermost Cretaceous to earliest Paleogene strata (encompassing the K/Pg boundary) in the Jiaolai Basin. Samples from a new Jiankou section yielded abundant ostracods assigned to twelve genera and twenty-seven species, reported for the first time from the Jiaozhou Formation in this area. The assemblage is composed entirely of non-marine taxa, including species of *Cypridea*, *Talicypridea* and *Candoniella*. Ostracod biostratigraphy indicates this section to be Campanian to early Maastrichtian in age, but not including the K/Pg boundary commonly present in the upper part of the Jiaozhou Formation. Palaeoenvironmental analysis of the species composition of the assemblages obtained, combined with a study of valve ornamentation, suggests that during the late Campanian, an ephemeral pond or small ephemeral lake alternated with a permanent lake in the studied area, and during the Campanian to Maastrichtian interval, there was a seasonally expanding and shrinking lake with both permanent and ephemeral basins in the studied area.

## The ornamentation of *Vlakomia* and its possible relation to a transgression event

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The Genus *Vlakomia* was established by Gramm (1966) and was assigned to the superfamily Cytheroidea based on the adductor muscle scar pattern. Also, Gramm (1966) first identified the sexual dimorphism in *V. ustinovskii*, the type species of the genus – the female morph possesses larger and more elongated carapace/valve whereas the male one has smaller and shorter carapace/valve (typical character of the subfamily Timiriaseviinae). However, Choi *et al*. (2019) restudied specimens of the genus *Vlakomia* and found out that they have sieve-type pore canals of type C (i.e. a sieve plate with a pore and sensory hair emerging from its center) and sexual dimorphism – male morph is larger than female one (typical character of the subfamily Limnocytherinae). Thus, Choi *et al*. (2019) assigned the genus *Vlakomia* to the subfamily Limnocytherinae of the family Limnocytheridae. Two *Vlakomia* species were recovered from the Tongfosi Formation: *V. jilinensis* and *V. ustinovskii*, which is also the earliest record of the subfamily Limnocytherinae in China or even in the East Asia. Specimens of *V. ustinovskii* show much stronger ornamentation, which distinguishes them from those of *V. jilinensis*. Sha (2007) and Sha *et al*. (2008) proposed a hypothesis that during the Aptian–Albian a big transgression happened in the northeast China which may reach the Yanji Basin. However, this hypothesis remains controversial up to now, because no well-preserved uniquely marine micro- or macrofossils have been reported from the Aptian-Albian sediments in Yanji Basin. Recently, we recognized the marine biomarker records ($C_{30}$ sterane biomarkers that are typical of marine algae and sponges) from layers in the Tongfosi Formation bearing *Vlakomia*, providing the direct and solid evidence for the transgression that reached the Yanji Basin at that time. Additionally, the $C_{30}$ steranes are more abundant in the *V. ustinovskii* bearing layer than in the layer with *V. jilinensis*. Therefore, we propose that the strength of marine incursion may influence the degree of the ornamentation of *Vlakomia*.

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**Tracking the Older Holsteinian Oscillation: a high-resolution ostracod record from Eastern Poland**

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The study of past interglacials can contribute significantly to improving our predictions of future climate change and their potential environmental impact. In this framework, the Holsteinian Interglacial correlative with Marine Isotope Stage 11c (MIS 11c) – appears to be one of the closest palaeoclimatic analogues for the present interglacial, on the basis of the similarity of its orbital parameters with those of the modern.

The aim of the present study is to record distinct intra-Holsteinian cooling. It would be one of the first multi-proxy records of the OHO from Eastern Europe. Lake sediments exposed in Ortel Królewski II (Lubelskie, Eastern Poland) are characterized by a remarkable abundance of molluscs and ostracods, in many cases constituting over 70% of the deposits. Therefore, variability in the structure and composition of the ostracod assemblages enables high-resolution palaeoecological reconstruction. The excellent preservation of shell material and sediment features points to a lack of or limited transport prior to deposition.

In total, 39 samples have been examined at a sampling interval of 2 cm.They represent the pre-optimal part of the Holsteinian Interglacial, corresponding to the *Pinus-Larix* pollen zone. The ostracod assemblage at Ortel Królewski II contain at least 12 ostracod species, represented by almost 12,000 specimens. *Scottia browniana*, *Darwinula stevensoni* and *Metacypris cordata* dominate the ostracod assemblage, with *Ilyocypris bradyi*, *Limnocythere inopinata* and *Cypridopsis vidua* present in accessory quantities.

The profile has been divided into three main zones based on ostracod ecological preferences: (i) deeper conditions during an initial lacustrine phase, followed by (ii) an expansion of aquatic plants recorded through high charophyte abundance and increased abundance of *M. cordata*, and (iii) a final phase of shallowing. In the second and third phase, the dominance of *S. browniana* and *M. cordata* reflects ongoing eutrophication and progressive shallowing as the lacustrine setting transformed into marshlands.

Additional data is expected from isotopic studies($\delta^{18}O$, $\delta^{13}C$) currently in progress. It is anticipated that integrated isotopic and ostracod analyses should enable a reconstruction of this short-term climate oscillation.

**Cuticle ultrastructure and calcification in the carapace of the myodocopan ostracod *Euphilomedes japonica***

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It is known that the procuticle of the carapace in most podocopans is mineralized by calcite, whereas in myodocopans it is either unmineralized or mineralized by monohydrocalcite. Some previous studies on the cuticle morphology of myodocopan ostracods have been published, but the cuticle structure and its formation of myodocopan carapaces are still in dispute and mostly unknown.

The cuticle ultrastructure and its formation of the myodocopan ostracod, *Euphilomedes japonica*, are investigated by SEM and TEM. The carapace of this species consists of outer and inner lamellae, and each lamella includes a cuticular and an epidermal layer. The outer lamella cuticle is composed of four cuticular layers; epicuticle, exocuticle, endocuticle and membranous layer – comparable to the exoskeleton in other arthropods. The exocuticle and endocuticle are calcified by calcite and the cleaved surface of endocuticle reveals calcareous polyhedral grains. The chitin-layered and the organic mesh matrices develop within the exocuticle and endocuticle, respectively. At the muscle attachment sites, numerous intracuticular fibers pass through from the basal to the apical part of the outer lamella cuticle and smaller polyhedral grains are found there. Hemocoelic sinuses develop in the cellular layer between the outer and inner lamella cuticles.

The outermost layer of the new cuticle (epicuticle) is secreted first and the inner layers are added proximally in the pre-, and post-moult stages. The calcification takes place in the whole area of the carapace simultaneously, together with the synthesis of the organic mesh within the endocuticle. Amorphous calcium carbonate deposits as calcareous spherulites at the distal part of the procuticle in the early post-moult stage and finally calcareous polyhedrons come out resulting from the radial growth of spherulites within the organic mesh of the endocuticle. This research elucidates that the cuticle ultrastructure and calcification in myodocopan carapaces are different from those in podocopan ones, and concludes that the structural diversity in myodocopan carapaces contributes to the adaptation to various lifestyles.

## Quaternary ostracod assemblages of the northeastern Black Sea shelf

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The connection of the Black Sea with the Mediterranean has been episodic during the Quaternary. Fewer shorter intrusions of water from the Caspian basin have occurred via the Manych Corridor during the Pleistocene. These intrusions have greatly influenced the environmental conditions of the Black Sea, creating the biota that inhabited the basin. Thus, the fossil ostracod assemblages typical for completely different hydrological conditions, from marine to almost freshwater ones, are observed in the Black Sea sediment records from different Quaternary time intervals.

This research is performed on sediment samples from the geotechnical borehole RBH16 drilled at the north-eastern Black Sea shelf edge off the town of Anapa; two gravity cores Ak-521 (44.26°N, 38.54°E, water depth 101 m; 200 cm long) and Ak-2575 (44.22° N, 38.63°, water depth 99 m; 186 cm long) taken from the Caucasian shelf between Arkhipo-Osipovka and Dzhubga, and two late Holocene mini-cores: Ash 2009-08 (44°32.454'N, 38°01.235'E, water depth 31 m; 28 cm long) and Ash 2012-02 (44°32.622'N, 37°57.120'E, water depth 60 cm, 44 cm long).

Four ostracod assemblages with different species composition are distinguished in Quaternary deposits from the northeastern Black Sea shelf (Zenina *et al*. 2017, Zenina *et al*. 2019 in press). Chaudian assemblage (I) (found only in the borehole RBH16, interval 15.55–14.11 m), represented by the Caspian-type fauna, includes diverse ostracod species composition and is typical for the Chaudian basin (Early Neopleistocene). Neoeuxinian assemblage (II) was recorded in the Upper Pleistocene deposits of the Neoeuxinian basin and the Early Holocene Bugazian and Vityazevian deposits (13.6–8.7 cal. ka BP). Significant changes of the aquatic environmental conditions (temperature and salinity) occurred at this time, which are reflected in the ostracod records. Depending on difference in species composition, this assemblage is subdivided into two subassemblages IIA and IIB. Subassemblage IIA is characterized by a wide variety of Caspian-type species and existed before the Holocene. Subassemblage IIB is typical for the beginning of the Holocene, when water exchange of the Black Sea with the Mediterranean Sea just started (Zenina *et al*. 2017). Transitional assemblage with Mediterranean and Caspian fauna (III) covers the middle Holocene deposit (7.4-6.8 cal. ka BP) and includes 25 species of Caspian type and 5 species of Mediterranean type. The regular occurrence of Mediterranean migrants on the northeastern shelf is recorded within the assemblage III in sediments younger than 8.7 cal. ka BP. The marine assemblage IV was found in deposits younger than 6.8 cal. ka BP.

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# POSTER ABSTRACTS

**Valve shape variation in a non-marine ostracod morphospecies *Heterocypris salina* (Brady): Geometric morphometrics approach**

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*Heterocypris salina* is a halophilic ostracod which prefers brackish coastal and inland waterbodies but rarely occurs also in freshwater habitats. Individuals of this Holarctic morphospecies are known to display considerable variation in carapace shape and size, resulting in description of some extreme phenotypes as separate species, which in turn have been recently lumped back into one species *H. salina*. However, recent DNA barcoding analyses have revealed cryptic diversity in this morphospecies. In the present study we used geometric morphometrics approach towards assessment of intra- and inter-population variation of valve outline based on 176 female individuals identified by morphological criteria as *H. salina* and originated from seven all-female sites situated in Italy (SIT40, SIT51, SIT52), Morocco (MA2 and MA3) and Poland (OZ and RE). After the outline approximation of 158 right and 163 left valves according to the B-spline algorithm, multivariate ordination techniques (Principal Coordinate Analysis PCO and metric Multidimensional Scaling mMDS with bootstrap averaging) were used for graphical visualization and distinction of the studied populations by the valve shape, that was further statistically tested by Permutational Multivariate Analysis of Variance (PERMANOVA). Our analysis demonstrated statistically significant differences in pair-wise tests between all pairs of the studied sites, though without a generally consistent geographical pattern. On the one hand, mutually most similar and displaying low within-site average distances were individuals from three south Italian sites. On the other hand, two Polish sites were clearly distinct from each other, females from coastal RE site appeared most similar to those from Italian SIT40, whereas females from inland OZ to those from Moroccan MA2. Discrimination between the sites by the Canonical Analysis on the Principal Coordinates (CAP) was significant, and percent of females that were correctly classified in each site was high, ranging from 83.3% (RE) to 100% (MA3 and SIT52). Finally, it is worthy of note, that sites with females of the highest within-site phenotypic variation of the valve shape (RE and MA3) appeared coherently to be inhabited by most genetically variable individuals. Moreover, our analysis demonstrated also statistically significant valve shape differences in pair-wise tests between some putative cryptic species revealed by the DNA barcoding.

# Power frequency electromagnetic field (50 Hz) affect life history traits of a temporary water ostracod *Heterocypris incongruens* (Crustacea, Ostracoda)

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We examined in laboratory settings effects of power frequency electric (EF, 14 kV/m) and magnetic (MF, 150 μT) field exposure, mimicking that of high voltage overhead transmission lines, during incubation and hatching on viability of resting parthenogenetic eggs of a cosmopolitan freshwater ostracod *Heterocypris incongruens* obtained as Ostracodtoxkit from MicroBioTest Inc., Belgium. Eggs were incubated dry in one of three conditions: EF, MF and control (C), and then inundated with water and assigned to one of two hatching conditions: either same as in incubation or C. Eggs incubated in C were assigned either to EF, MF or remained in C. Difference in: hatching success, dynamic of hatchability, and juvenile survival between control eggs/juveniles and those exposed to each of stress treatment combination was compared in the balanced design. MF significantly affected dynamic of hatchability: 40% of neonates appeared at 4 days in MF vs. 8 days in C, however, final hatching success was equal in all combinations of treatments. Incubation in both MF and EF significantly affected juvenile survival: only 21.7% (vs. 51.7% in C) and 16.7% (vs. 41.7% in C) of juveniles reached the adult stage in MF and EF, respectively. Thus, power frequency electromagnetic field can have important consequences for fitness-related life history traits of aquatic invertebrates.

## Biogeography of planktonic ostracods across different hydrographical zones of Drake Passage (Southern Ocean)

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Planktonic ostracods contribute to a significant proportion of oceanic mesozooplankton assemblages in the Southern Ocean. Locally occurring in high abundance they have the potential value as indicators of observed recent climate changes. The aim of this study was to investigate the composition structure and horizontal distribution of pelagic ostracods within the upper 300 m layer along the Drake Passage transect, the area under a profound influence of not only the dynamics of sea currents in the Southern Ocean, but also of the earth's climate. This investigation carried out in austral summer 2010 delivered very complex picture of latitudinal changes in community structure of planktonic ostracods because our sampling crossed 3 main hydrographically different sectors including the Subtropical, Subantarctic and Antarctic Zones. Twelve pelagic ostracod species were found in 21 stations situated along a transect between King George Island and Argentina. The Antarctic Zone was evidently distinguished from other two zones in terms of species number and individual abundance, while the Polar Front and Subantarctic Zones were similar in term of taxonomic composition. Comprehensive analysis of ostracod distribution allowed us to indicate species typical of particular zones, namely *Alacia hettacra* as dominating species in the Antarctic Zone, *Discoconchoecia elegans* in the Polar Front Zone and *Pseudoconchoecia serrulata* in the Subantarctic Zone. Moreover, the contribution of pelagic ostracod species was assigned to 5 biogeographical origins (Antarctic; Notal-Antarctic; Notal; widely distributed and Subtropical). By using a distance-based linear model (DistLM) routine this study delivered also extensive ecological characteristics of Drake Passage halocyprids regarding the influence of temperature, salinity and oxygen concentrations. Tested in the redundancy analysis (dbRDA) environmental variables explained together 58% of variability in species composition. Seawater temperature was the strongest factor (38% of variation explained), while examined for the first time on this group - oxygen also contributed substantially to the overall ostracods variability. It has been also clearly shown that *Conchoecia magna* - a mesopelagic species that is widespread throughout tropical and subtropical seas - was distributed further south than earlier described in the literature. So far the occurrence of that species in the Southern Ocean has been restricted to the north of the Subantarctic Front. Our results indicated that this subtropical species crossed its southern boundary of distribution range and hereby confirmed the important role of ostracods in monitoring the impact of climate changes in the pelagic Antarctic ecosystem.

## Does fractal dimensions of *Salvinia* species change the composition of ostracod communities in tropical floodplain lakes?

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Aquatic plants provide physical structures that increase the complexity and heterogeneity of aquatic habitats, thus influencing the structure of the communities, because the more complex the habitat, the greater the potential richness and abundance of organisms. However, few studies show the effect of plant complexity on the composition of aquatic communities. The genus *Salvinia* comprises the most abundant free floating macrophyte species of the Upper Paraná River floodplain, Brazil. *Salvinia auriculata* Aubl., *S. herzogii* de La Sota, and *S. minima* Bak have similar morphological characteristics, however, they differ in their structural complexity. Here, we assess the composition of ostracod communities associated with these three species of *Salvinia*, through the measurement of fractal dimensions. We test the hypothesis that the structural complexity of the macrophytes changes the species composition in the limnophase period, because the flood pulse might homogenize the fauna. The collections were performed in January and February 2011 (potamophase) and in July 2012 (limnophase), in 27 lakes of this floodplain. *Salvinia* were hand-collected and plants were thoroughly washed in a bucket to remove the ostracods. The material was filtered in net with mesh size c 160 μm. The samples were preserved in 70% alcohol. Plant complexity was measured by the fractal dimension according to a procedure adapted from Thomaz *et al*. (2008). We used Principal Coordinates Analyses (PCoA) to evaluate the (dis)similarity amongst the three species of *Salvinia*. Thirty species of ostracods were recorded, distributed in four families (Cyprididae, Candonidae, Limnocytheridae and Darwinulidae). The ostracod composition of *S. herzogii* differed significantly from *S. minima* and *S. auriculata*, despite the difference in complexity between *S. minima* and the other two species of *Salvinia*. The species composition could have been influenced by a combination of abiotic and biotic factors, such as the specific traits of the plant species and the competition amongst species, which could overlap the effects of structural complexity.

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# Extreme drought periods can change spatial effects on periphytic ostracod metacommunities in river-floodplain ecosystems

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Riverine floodplains are excellent ecosystems to study metacommunity structure over time, owing to the presence of temporal variability in the hydrological regime, mainly related to the variation in water level. Thus, since in these environments the local and regional factors change at different temporal scales, factors structuring metacommunities might also differ over time. However, temporal dynamics of metacommunities have rarely been assessed. We investigated the influence of environmental (e.g. physical and chemical variables) and spatial (e.g. dispersal limitation) factors over time on the metacommunity structuring of periphytic ostracods in the river-floodplain system of the Upper Paraná River, Brazil. Ostracods were collected between February 2014 and May 2015, totalizing six collections, in 15 sampling sites of this ecosystem. *Eichhornia crassipes* (Mart.) Solms and *Eichhornia azurea* (Swartz) were removed manually from the water, the roots were washed in plastic bucket to remove the periphytic ostracods, and the material retained in the bucket was filtered through a hand net with 160 μm mesh size and preserved in 70% ethanol buffered with borax. We selected both species of *Eichhornia* because they are the most abundant in the river-floodplain system. We recorded 40 species of ostracods, belonging to four families. The pRDA analysis showed that the spatial factors turned out to be more important than environmental factors, and differences in the percentage of explanation of the factors structuring ostracod metacommunities over time was significant, mainly during extreme drought period. The variation in ostracod metacommunity composition was almost entirely attributed to turnover rather than to nestedness for all sampling periods, and the highest values of overall diversity and turnover was found in the extreme drought. Our results showed that the high spatial influence might be related to the low connectivity amongst environments during such extreme drought periods, which can increase dispersal limitation, and consequently can increase the turnover of ostracod species throughout the region, leading to a higher beta diversity of ostracod metacommunities.

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**Predicting the potential invasive distributions of native South American ostracods to the African continent**

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The increase of globalization has facilitated the introduction of small alien species, mainly through trade and transport of goods and people. We used Ecological Niche Models (ENMs) to predict the potential distribution area of nine species of *Strandesia*, endemic to South America, on the African continent. We also identified the African basins that are most vulnerable to potential future invasions. The species occurrences in South America were obtained from published articles and collection data. They were mapped on a geographic grid of cells of 25 km$^2$ of latitude and longitude following river networks. Hydrological variables (HYDRO1k), bioclimatic variables (Wordclim version 2.0) and average altitude (SRTM) were rescaled to the grid. Six ENMs (Bioclim, Euclidian Distance, Gower Distance, Ecological Niche Factor Analysis, Maximum Entropy and Genetic Algorithm for Rule Set Production) were used in the analyses. The consensus models of the species, used to reduce predictive uncertainties, were considered only in the cells for which at least 50% of the ENMs indicated potential presence of the species. The suitability matrices range from 0 to1, in which values equal to 1 correspond to ideal habitat conditions and values equal to 0 correspond to suboptimal habitat conditions for the species. In general, the consensus model showed that all nine species have potential to spread through African basins. Among them, *Strandesia obtusata* was the species with greatest habitat suitability (0.61) and greatest invasive potential in Africa (18,630 cells; 465,750 km$^2$). On the other hand, *Strandesia nupelia* was predicted to occur in only 9,765 cells (244,125 km$^2$), thus showing a low invasive potential (0.12 maximum value of habitat suitability). The African West Coast, Congo, Lake Chad, and the Niger and Nile basins have suitable areas for the occurrence of the nine species of *Strandesia*, whereas Red Sea - Gulf of Aden Coast and Africa - South Interior regions were less prone to invasion, with only four species expected. Among all African basins, Congo has presented the most susceptible drainage in receiving South American *Strandesia* species. This basin has environmental characteristics closer to those from South American basins and can be considered a potential invasion hotspot of *Strandesia*. The above results only refer to the potential to invade certain parts of Africa, once the species have reached the continent, not to the probabilities of actually reaching the continent.

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# A striking case of convergent evolution in two species of Cypricercinae (Crustacea, Ostracoda), with the description of a new genus and species from Brazil

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There are about 300 species and 62 genera of non-marine ostracods described from the Neotropics. Approximately 62% of all species belong to the family Cyprididae. Cypricercinae is the most diverse subfamily of Cyprididae, with 11 genera and 171 species. The morphology of these species can show a great plasticity in shape, structure and size of the valves. However, cases of convergent evolution occur, and so unrelated species can demonstrate a great similarity in valve morphology. Here, we provide a case of convergent evolution within the Cypricercinae, namely between the circumtropical *Bradleytriebella lineata* (Victor & Fernando, 1981) and a new genus and new species of the same subfamily, both from Brazilian floodplains. Ostracods were collected from the sediment-water interface (littoral) and from aquatic vegetation, in the Amazon, Araguaia and Paraná rivers floodplains (Brazil). The two cypricercine species look superficially similar, with comparable valve and carapace shapes and especially ornamentation, as in both species the valves are densely set with longitudinal ridges. However, examination of the limb chaetotaxy shows important differences, especially in the chaetotaxy of the maxillula which shows reduced numbers of claws and setae; in the first thoracopod, in which seta 'b' has taken a giant aspect in the new taxon compared to a normal shape in *B. lineata*; and in the antenna, where the new species has an aesthetasc Y with normal size (compared with other Cypricercinae), whereas *B. lineata* has a very large aesthetasc Y. These, and other, differences merit the allocation of these two species to different genera and even tribes within the subfamily Cypricercinae and necessitate the description of a new species and genus.

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**Marine sediments in the micropalaeontology collections of the Muséum national d'Histoire naturelle: overview and potentials**

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The Muséum national d'Histoire naturelle (MNHN) of Paris, France, houses collections of major importance in the history of palaeontology and particularly of micropalaeontology. The contributors of these collections are diverse, from MNHN researchers to institutions as the French Oil Institute, scientists and explorers as Jean-Baptiste Charcot, Jacques-Yves Cousteau. They gather major historical collections such as Foraminifera of Alcide d'Orbigny, bought by the MNHN in 1858, which led the groundwork for micropalaeontology and biostratigraphy. Others paved the way to modern micropalaeontology such as George Deflandre's collection, who pioneered in the fields of algology, protistology and palaeoprotistology, or Nicolas Grekoff's material, which is a key contribution to modern ostracodology.

Besides these central collections, the MNHN also stores numerous modern marine sediments that are still not documented. Following the recent demonstration on material collected during the HMS *Challenger* voyage around the globe from 1872 to 1876, the sea-bottom sediments stored in the MNHN might provide snapshots to describe the changes related to anthropic influence through time and space. The MNHN preserves material collected by the *Travailleur* and *Talisman* cruises from 1880 to 1882, *Pourquoi-Pas?* in Rockall and Jan Mayen in 1921, *Lapérouse*, *Astrolabe* and *Octant* along Indochina shores in 1926, *La Calypso* voyage in the Red Sea in 1952, to cite only a few of them. A large project of documentation of these important collections has begun and here I propose an overview of the sea-bottom sediments stored in the micropalaeontology collections of the MNHN and their potentials for ostracodologists.

**Recent brackish water Ostracoda and Foraminifera from two lagoons of Ghana, and their potential as environmental indicators**

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Coastal zones and in general the transitional environments between marine and continental ecosystems are among the most densely populated areas of the world with consequent conflicting economical and other interest of use. In the developing African nations this risk is increasing because of the difficult balance between the fast economic and population growth, the limited ecological knowledge and the high cost of continuous coastal zone management. An efficient and low-cost tool for water quality monitoring and reconstruction of reference conditions are microfossils. Foraminifera are already established in this role but decrease in abundance and diversity with decreasing salinity in estuarine settings, but Ostracoda are present within the same samples and take over in mesohaline to oligohaline waters. Because the ostracod and foraminifer fauna of brackish waters in western Africa is poorly known so far, we investigate two estuaries from Ghana in order to calibrate sensitiveness of Ostracoda and Foraminifera as environmental indicators, especially anthropogenic impacts.

We analyzed 22 surface sediment samples for microfauna. They are covering a salinity range from marine waters to 17.5 (psu) with one sample within the hyperhaline range (70). Except one, all contain Ostracoda and Foraminifera. There are 34 ostracod species belonging to 22 genera. Dominating is *Cyprideis remanei* Klie, 1940, other abundant species are *Pseudoconcha* sp., *Pseudoconcha hartmanni* (Omatsola, 1970), *Loxoconcha lacunensis* Omatsola, 1970 and *Chrysocythere foveostriata* (Brady, 1870). We found 26 Foraminifera species belonging to 24 genera with the dominant taxa *Ammonia tepida* (Cushman, 1926) and *Quinqueloculina* sp. We can discriminate two associations with three sub-associations each, which are mainly driven by salinity variation and pollution. The most tolerant (salinity and pollution) Ostracoda taxon is *Cyprideis remanei* occuring over the whole salinity range documented.

In the investigated samples we found many deformed Foraminifera with anomalies like multiple tests, changes in coiling and aberrant shapes of the chambers. Principal component analysis (PCA) of Foraminifera showed correlation of malformations with arsenic indicating nearshore pollution.

Ongoing investigations in estuaries of Ghana are enlarging our data set and will provide a better understanding of species-specific reactions of Ostracoda and Foraminifera to anthropogenic pressure.

# Spatial variation of ostracod (Crustacea, Ostracoda) egg banks in temporary lakes of a tropical floodplain

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Ostracods can produce drought-resistant eggs, which accumulate in the sediment, forming a bank of propagules that can remain viable for many years. Here, we evaluate the spatial variation of the ostracod resting eggs in different regions of temporary lakes of the Upper Paraná River floodplain, Brazil. We hypothesize a similarity in composition and abundance of ostracod eggs between the centre and edge areas (peripheral) of the temporary lakes. Sediment samples (the egg banks) were collected using a core sampler in the dry period (September 2017) in both regions of five temporary lakes. Sediments were oven-dried, then re-hydrated with distilled water and kept in germinating chambers to hatch the eggs, with controlled temperature and photoperiod, for 91 days. The incubation period was monitored weekly. Every seven days, the water from the microcosm was filtered using a plankton net. After that, the water of the microcosm was replaced by new distilled water. The filtered material, retained in the net, was sorted under a stereoscope. The juvenile ostracods were stored separately alive in Petri dishes and were kept until they reached the adult stage for species identification. Twelve ostracod species, belonging to families Cyprididae and Candonidae, were recorded from the egg banks of the lakes. *Cypridopsis vidua*, *Cypricercus centrurus* and *Bradleytriebella trispinosa* hatched only from sediments from the central regions of the lakes. A total of 553 ostracod specimens hatched from the sediments of the five temporary lakes. Our results showed that the abundance and species composition was similar between the regions of the lakes. Flood events may be responsible for the homogenization of the egg banks, owing to the connection of the lakes with the principal channel of the Paraná River. The entrance of water can mix the sediments of these lakes, and thus distribute the resting eggs to the edge and the centre of the lakes.

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**Ostracod metacommunities from Mediterranean temporary ponds: regional variations and driving factors**

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Mediterranean temporary ponds, mostly distributed in dry and sub-arid areas, are known to undergo cyclic periods of flooding and intense droughts. These ponds also show a wide variability depending on their geology, geomorphology, depth and origins of the water. Under the current projections of climate change in the Mediterranean region with shifts towards warmer temperature, reduced precipitation and intensification and extension of the drought periods, these vulnerable ecosystems are prone to an increased risk. Climatic changes may affect the resilience and resistance of pond ecosystems which may trigger irreversible shifts in biodiversity and consequently the ecosystem services may be lost. Ostracods are good proxies to monitor changes in pond ecosystems and to assess the recovery potential to the initial state after hydrological disturbances. Here, we examine the determinants of ostracod metacommunity structure across 32 Mediterranean temporary ponds located over an area of 13,000 km$^2$ in eastern Spain. Specifically, we aim at determining whether ostracod communities exhibit neutral spatial structuring or if they are structured by local environmental features under niche-based control. The analysed ostracod communities were represented by 38 species. The most frequent species found were *Eucypris virens* and *Cypridopsis vidua*. According to redundancy-analyses the ostracod communities were primarily related to environmental factors and secondarily to geographical location of the ponds within the same hydrographic basin. The highest altitude ponds (> 900 m a.s.l.), with water supplied by rainfall, were less diverse and dominated by relatively cold-tolerant species such as *E. virens*, *Tonnacypris lutaria* and *Pseudocandona albicans*; whereas the highly connected ponds in the lowlands (< 200 m a.s.l.), with more eutrophic, warmer waters and supplied by a mixture of rainfall, rivers, canals and groundwater input, showed a high diversity of species, dominated by *C. vidua* and *Heterocypris salina*. In the latter group of ponds, a significant contribution to species richness is due to the presence of exotic species such as *Fabaeformiscandona subacuta*, *Dentocypria* sp. and *Hemicypris barbadensis,* which establish abundant populations especially in the ponds close to rice fields and prone to human impacts. Our findings suggest that ostracod communities are composed of a mixture of species with limited dispersal within relatively small spatial scales. This point to their vulnerability in case of habitat reduction or destruction, especially for isolated ponds dependent on runoff for their recharge, in addition to cosmopolitan species with high dispersal abilities. The well-connected lowland ponds and wetlands may be prone to alterations of the communities owing to the high number of exotic species that might affect the survival of autochthonous taxa. At present, temporary ponds in Mediterranean areas are gradually recessing and under high treats owing to the dual impact of climate (prolonged periods of drought) and invasion by new colonisers.

**Pliocene microfauna, stratigraphy and palaeoenvironment of the Productive and Red Series in the South Caspian Basin**

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This study details the biostratigraphy of the Productive and Red series in the South Caspian Basin analysing the ostracod fauna and reconstructing the Lower Pliocene palaeogeography and palaeoenvironments of the South Caspian Basin. The study is based on an examination of 151 core samples collected from 41 deep wells drilled over 29 structures. This study also reports the use of ostracod rapid-evolutionary trends and changing assemblages in Lower Pliocene biostratigraphy, which is also supported by recorded wells log data. Using seismic, logs and biostratigraphy data we attempted to reconstruct palaeoenvironments of the Productive and Red series of the South Caspian Basin. Ostracods in the Productive and Red series originally lived in the Pontian brackish basin. In the Early Pliocene the basin gradually freshened with continuous regression. The increasing sedimentation rate in the basin during the deposition of these two series caused the shallowing of the basin and considerable turbidity of the water, creating unfavourable conditions for the life and fossilisation process of benthic organisms. Microfaunal diversity and population density in the offshore Lower Pliocene Productive and Red series are considerably lower than in the onshore series. Three ostracod assemblages were used in the stratigraphic subdivions of the Productive and Red series in the South Caspian. Ostracod taxa in the Productive and Red series are typical representative of saline, euryhaline, and brackish environment.

**The valve shape variability in ten species of *Heterocypris* occurring in Europe**

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Worldwide distributed genus *Heterocypris* has mixed reproduction that is considered to be one of the reasons of its great morphological variability, especially in carapace morphology. On the other hand, features on the carapace and valves are considered as important taxonomic characters and most frequently the only available in palaeontological and palaeoecological studies. The aim of this study was to give an insight into valve shape variability by illustrating differences in valve shapes among 31 populations of this genus occurring in Europe, originated from Pannonian Plain, Balkan Peninsula and Iberian Peninsula.

Utilizing Morphomatica software, 350 left and 350 right digitized valve outlines were compared. Males were present in eight populations belonging to seven species, with 52 left and 51 right valves processed. Separately for females and males, mean specimen outline was obtained for each population. The populations included in the analyses are: eight populations of *Heterocypris incongruens*, six populations of *H. rotundata*, three populations of *H. barbara*, *H. salina* and *H. vitrea*, two populations of *H. bosniaca* and *H. reptans*, and one population of *H. bulgarica*, *H. erikae*, *H. exigua* and *H. gevgelica*. Cluster analysis and Multidimensional scaling on the Mean delta quadrate matrices provided from Morphomatica were performed for left and right valves separately.

Overall, greater distances are present in left valve shape variation among species, populations and sexes. All conspecific populations grouped together in Cluster diagrams and MDS plots, both for left and right valve, where *Heterocypris salina* was the most distant from other species by its defined left and right valve shape. In *Heterocypris reptans* valve shapes showed greatest distance in their variability between two analyzed populations and between sexes, as they individually grouped closer to other species. This species is clearly distinctive by the short natatory setae on the second antenna, and its valve shape variability could be interpreted as a consequence of the environmental components. Similar separations of some populations happened in *H. rotundata* that grouped with *H. bulgarica*. With inclusion of soft part morphology in further investigations, these findings could bring more light on the status of some analyzed taxa, and possibly clarify synonymies and other taxonomical issues within this genus.

**The Wouters organ presence and its detecting in Heterocypris**

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In 2008, Robin Smith and Renate Matzke-Karasz presented a large survey on the morphology and presence of the Wouters organ within Cypridoidea. The new organ was present in the genera *Hemicypris* and *Homocypris*, but not detected in *Cyprinotus* or the cosmopolitan genus *Heterocypris* of the subfamily Cyprinotinae.

With the aim to explore the possibilities to spot this tiny structure in *Heterocypris*, ten females from ten different species occurring in Europe were examined. The exception was *Heterocypris exigua*, where 9 specimens were inspected. Next to this, the species investigated were *Heterocypris barbara*, *H. bosniaca*, *H. erikae*, *H. gevgelica*, *H. incongruens*, *H. reptans*, *H. rotundata*, *H. salina* and *H. vitrea*. To detect and measure the Wouters organ, both left and right antennulae were observed and photographed using a Zeiss Axioimager microscope with a magnification of 500 times. The Rome organ was also measured, as well as the distance of the Wouters organ from the first setae on the antennulae, to determine its position.

The presence of the vase-shaped Wouters organ is noted in all analyzed species at 64.60 μm mean distance from the first seta. The mean length of this sensory organ was 5.93 μm and the success of its detection was 63% in total. The Rome organ was successfully detected in almost 90% of the examined antennules, with the mean length of 10.27 μm.

It is interesting that the Wouters organ is found in one more species with short natatory setae on the second antenna, namely *Heterocypris reptans*. These results also emphasize that the Wouters organ is probably present in many species but it is just overlooked. The success in finding it is related to conservation of the sample, dissection techniques, slide preparation procedure, stronger magnification and looking for it in a larger number of prepared specimens.

**Molecular evidence of widespread prevalence of intracellular bacteria *Cardinium* in parthenogenetic females of an ostracod *Heterocypris salina* (Brady, 1868)**

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Many arthropod species are engaged in a diverse range of relationships with endosymbiotic bacteria that exert various effects on biology, evolution and reproductive ecology of their hosts. One of the best studied examples of such interactions includes the intracellular bacteria *Cardinium* and *Wolbachia* interfering with host reproduction. Exact effects of these bacteria on host fitness are, however, largely unknown. It is thought that both maternally transmitted endosymbionts can manipulate host reproduction by feminization, cytoplasmic incompatibility or induction of thelytokous parthenogenesis.

Here, we present a report of screening for natural infection of *Cardinium* and *Wolbachia* in parthenogenetic females of a halophilic ostracod species *Heterocypris salina* collected from eight sites situated in the circum-Mediterranean region (Greece, Italy and Morocco) as well as two sites in Poland. The presence of both symbionts was tested using classic PCR amplification and direct DNA sequencing with a newly designed 16S rRNA-specific primers. Interestingly, all of the 126 tested individuals showed positive results for the occurrence of *Cardinium*. Our results are in concordance with those of other authors based on material from Turkey (Çelen *et al*. 2019) and other Greek site (Schön *et al*. 2018) and indicate widespread prevalence of *Cardinium* in *Heterocypris salina*. On the other hand, for now we found *Wolbachia* only in four individuals from the Polish sites, indicating low-level infection of the tested ostracod species with these bacteria (but see Bruvo *et al*. 2011).

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# New species of the genus *Elpidium* (Ostracoda, Limnocytheridae) from New Caledonia: alien invasives without a risk!

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Owing to the geological history of New Caledonia, situated in the Pacific Ocean, NE of Australia, the flora and fauna of the archipelago has a high proportion of endemism, which has attracted the attention of botanists, zoologists and biogeographers. The taxonomy and ecology of larger organisms, such as higher plants, birds and even molluscs, are relatively well known. Smaller groups, such as ostracods, on the other hand, were largely overlooked in the past. After three expeditions to New Caledonia (November 2016, November 2017, May-June 2018) we have now collected more than 350 samples from a variety of water bodies and have found close to 50 species of Ostracoda of which we expect c 30 to be new to science. In addition, we have found at least five new genera.

But the most surprising event was the discovery of several new species of the genus *Elpidium* F. Müller, 1880. Species of this genus have thus far only been found in the water "tanks" of bromeliad plants, and such bromeliads only occur naturally in the Neotropical (the few West-African species have no water tanks). However, parallel to international trade in ornamental plants such as orchids, there appears also to be a triving international trade in bromeliad plants, as we found many species of bromeliads in gardens of houses, schools and villages. When we sampled these tanks, a large portion of specimens indeed contained many specimens of *Elpidium*, at least 5 species in total. When comparing valves and male copulatory appendages with those of decribed species, it appeared that our species have not yet been described. We can thus also not pinpoint the geographical origin of these species in the Neotropical. However, since *Elpidium* can apparently only survive in bromaliads, there is no risk that these invasive ostracod species will be a danger to indigenous species.

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# Description of a new species of *Cypricercus* and of the male of *Cypricercus centrurus* (Klie, 1940) (Crustacea, Ostracoda) from Brazil

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The subfamily Cypricercinae (family Cyprididae) is one of the most diverse groups of recent non-marine Ostracoda and is characterized by the presence of a Triebel's loop in the attachment of the caudal ramus. The genus *Cypricercus* Sars, 1895 is the type genus of the subfamily and comprises at present 16 species (Meisch *et al*. 2019). The female of *Cypricercus centrurus* was described by Klie (1940) from Cachoeira Paulo Affonso (Alagoas State, Brazil). This rather common species was thus far only found in all-female populations. However, recent collections performed in Brazil, recorded sexual populations of *C. centrurus.* In addition, a new species of this genus was also found. Here, we present the first description of males of *C. centrurus,* a redescription of the females of this species and the description of *Cypricercus* sp. 1 nov. sp. from the river-floodplain system of the Upper Paraná River. Ostracods associated with roots from floating aquatic vegetation were collected by removing the macrophytes from the water by hand and placing them in a plastic bucket (Campos *et al*. 2017). The roots were washed in the bucket, the residue was filtered through a hand net with a mesh size of 160 µm and the material was preserved in 70% ethanol. *Cypricercus centrurus* is characterized by the presence of a spine on the posterior margin of the right valve. This species has a sexual dimorphism in size, as the male (length = ca. 1.100 µm) is smaller than female (length = ca. 1.240 µm). The morphology of the male is species-specific but does not deviate significantly from that of other species in the genus where males are known. Only females were found of *Cypricercus* sp. 1 nov. sp. This species has no spine on either valve and has a more elongated body, with a length of ca. 1.340 µm. The morphology of the new species is compared to all extant congeners and a differential diagnose is provided. The present study contributes to the knowledge of Neotropical ostracod biodiversity.

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**Ostracod Research in Morocco, Algeria, Tunisia, Libya and Egypt**

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The history of ostracod research in and on European circum-Mediterranean countries is long and detailed and mostly 'ready-to-use' for applied studies. We here review ostracod research (Recent and Holocene) in the Northern African countries Morocco, Algeria, Tunisia, Libya and Egypt, which have a much smaller, and less accessible ostracod research record. Few early limnologists at the beginning of the 20th century addressed this area, mainly delivering taxonomic and biogeographic information of living species (and a little ecology). Only in the 1980s, wider ecological assessments of water bodies and studies into their history emerged, which then continuously expanded from decade to decade, with the current one being represented by nearly twenty publications.

We here give a complete and extended list of publications dealing with ostracods of this region and provide some historic insights to the research of the early contributors.

This poster was created for presentation at the occasion of the first MULTIPP (Mediterranean Desert Margin and Drylands) workshop in March 2018, Institute of Physical Geography, University of Leipzig.

## Microfossils, chemostratigraphy and environmental changes in the Late Triassic (Rhaetian) of the Northern Alps (Austria)

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The Rhaetian was a critical period in Earth history and evolution since the biosphere was affected by two global extinction events at the Norian-Rhaetian boundary and in the late Rhaetian. The end-Triassic event has been subject to several studies since three decades and is now relatively well-understood. Much less attention has been paid to the Norian-Rhaetian event and to the period preceding the late Rhaetian event. Recent chemostratigraphic studies suggest that several negative carbon isotope excursions have occurred during the late Rhaetian. High-resolution multi-proxy geochemical, sedimentological and palaeontological analysis of middle-late Rhaetian oceanic and intraplatform basin deposits (Zlambach Formation, Kössen Formation) in the Northern Calcareous Alps (NCA) shows one significant environmental crisis that occurred in the late Rhaetian, prior to the End-Triassic mass extinction (ETME). This crisis is expressed by the rapid decline in abundance and diversity of ostracods, foraminifera and nannofossils and was probably linked with the termination of carbonate platform growth in the western Tethys (Mette *et al*. 2019). Calcareous nannofossil data also suggest a remarkable change in the composition of nannofossil associations during this late Rhaetian crisis that could indicate oceanic acidification prior to the ETME.

The Norian-Rhaetian boundary is recorded in pelagic and intraplatform basin deposits of the NCA. Recent micropalaeontologic and sedimentologic results from intraplatform basin deposits of the NCA point to a drastic palaeoclimatic change at the Norian-Rhaetian boundary in Central Europe which is in accordance with results of earlier sedimentologic research (Hallam 1985, Ahlberg *et al*. 2002, Berra *et al*. 2010).

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**Holocene freshwater ostracods from the highlands of Yemen and their paleoclimatic implications**

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Sediments of early and mid-Holocene age of Qa'a Jahran–Dhamar highlands, Yemen were analyzed for the occurrence of freshwater Ostracoda. Carapaces and valves of 15 species of freshwater Ostracoda have been recorded for the first time from the Holocene sediments of Dhamar highlands. They were collected during several field trips. The sampled deposits exposed in the quarries and incomplete dry wells and their faunal content can be considered as an excellent evidence for the formation of wetland environments in tectonic depressions. Climatic change in the Holocene has been responsible for a number of lake formation and fluctuations documented from paleo records throughout different regions of the world. A number of archaeological and geological studies by different authors have recorded dramatic increase in regional summer rainfall on the Arabian Peninsula during the early and mid-Holocene. This rainfall increase is considered primarily the result of an intensified Indian summer monsoon as part of the insolation-driven northward shift of the boreal summer position of the Inter-Tropical Convergence Zone (ITCZ) over the deserts of North Africa, Arabia and northwest India.

The high abundance of freshwater ostracods recorded from the subsurface marl deposits of our samples indicates a wetland (probably several ponds) in Jahran basin during the humid period of early and mid-Holocene. This is in accordance with the findings of previous authors of lake or marsh sediments in the intermountain basins of the highlands of Dhamar area which also indicate a period of higher moisture availability in the early and mid-Holocene. The development of wetland environment in the intermountain basins of the western Yemeni highlands offered a habitat for a typical local fresh water fauna such as Ostracoda and mollusks. Little is known until now about the freshwater ostracods of Yemen. Previous taxonomic work on freshwater ostracods in the region has discussed living *Heterocypris* Sars, 1903 and *Cyprinotus* Brady, 1886 and their Cainozoic fossil relative *Cheikella* Sohn & Morris, 1963 from Saudi Arabia and included some specimens from Yemen. Other authors focused on the taxonomy and distribution of Cladocera, Copepoda and Ostracoda from freshwaters of South Yemen. This study gives additional data on the climatic situation in the highland of Yemen during the mid Holocene based on the distribution of freshwater ostracods.

**Ecologically distinct Silurian ostracod faunas from a single horizon in Spain**

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For several decades now, the Silurian myodocope ostracod fauna has been recognized as the first planktonic component of the group. Although the colonisation event during the middle Silurian (Wenlock-Ludlow) is becoming well documented all around the world, the evolution of this fauna during the late Silurian (Pridoli) still remains unstudied. We describe here, for the first time, two ecologically distinct myodocope ostracod faunas coming from the same horizon in the late Pridoli (possibly *Istrograptus transgrediens* Biozone) of central Spain (Alcaracejos, Córdoba district). The first fauna comes from altered black shales and comprises five myodocope species associated with orthoconic cephalopods, bivalves, and graptolites. The second fauna was recovered from large dark-reddish calcareous nodules containing five myodocope species associated with the planktonic crinoid *Scyphocrinites elegans*, orthoconic cephalopods, phyllocarids, and bivalves. Although the shales and nodules share several myodocopes species, these two faunas seem to have had different ecologies, with the shales association representing the background planktonic fauna, while the nodules association would have lived in the vicinity of the *Scyphocrinites* 'floating islands'. These two faunas may have been living in different parts of the water column.

# Deep-sea benthic ostracods response to palaeoclimatic changes (MIS 5-Holocene, S Bay of Biscay)

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Late Quaternary marine ostracods from the Basque Basin have been studied based upon more than forty-four thousand specimens contained in a hundred surface samples and core samples from shelf to bathyal cores in the S Bay of Biscay. A total of 155 species belonging to 67 genera have been taxonomically described (Rodriguez-Lazaro *et al*. 2018). Palaeoceanographic evolution of the last 130 ka (MIS 5 to MIS 1-Holocene) in the Bay of Biscay has been studied by considering changes of microfossils from sediment samples of deep core PP10-17. This core was retrieved at 2882 mwd in the Landas Plateau (Brocheray *et al*. 2014) and is formed by 1792 cm of silty clay continuously deposited sediment, yielding more than sixty-two thousand specimens of foraminifers (182 species) and ostracods. Oceanographic and climatic changes have been characterised by benthic (BF) and planktonic (PF) foraminifer signals, besides stable isotopes and sediment parameters (granulometry, magnetic susceptibility, Gamma spectrometry) (Rodriguez-Lazaro *et al*. 2017). In this work we study the ostracod response to oceanographic/climatic changes in the region. Besides the records of more important species, the genus *Krithe* is studied in more detail. We found 10 species of Krithidae in these sediments: *Krithe dolichodeira* Bold, 1946, *K. minima* Coles, Whatley & Moguilevsky, 1994, *K. morkhoveni* Bold, 1960, *K.* aff. *pernoides* (Bornemann, 1855), *K.* gr. *pernoides* (Bornemann, 1855), *K. pernoides sinuosa* (Bornemann, 1855), *K. trinidadensis* Bold, 1958, "*K.*" (*Thracella*) gr. *bartonensis* (Jones, 1857), *Parakrithe dimorpha* Bonaduce, Ciampo & Masoli, 1975, *P.* sp. 1. Bottom conditions were suboxic during most of the studied interval, allowing the development of relatively poor ostracod fauna, and instability of palaeoecosystems is noted by low diversity (Shannon H index $< 1.5$) of these assemblages. The occurrence of PF *N. pachyderma* sin. is indicative of cold intervals. BF indicators of oxygen content are used as reference for comparisons with ostracods. Detailed responses to temperature and oxygen content in these waters are considered for *Krithe* and *Argilloecia*, the more representative genera inhabiting deep marine benthos. Shallow infaunal *Argilloecia* and deep infaunal *Krithe* exhibit a good adaptation to low-oxygen ecosystems. *Krithe* is related to deep-water formation (upper North Atlantic Deep Water) with highest occurrence during suboxic Last Glacial Maximum of glacial MIS 2.

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# Ostracod and foraminifer response to Late Pleistocene-Holocene volcanic activity in northern Victoria Land as recorded in Ross Sea (Antarctica) marine sediments

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Several studies have analyzed the impact of volcanism on the environment and biodiversity as well as the biotic effects of ash fall and other short term environmental crises on benthic invertebrates, both in recent and past environments. Most of these studies were focused on Foraminifera while scarce attention has been paid to the response of ostracods to such environmental crises, often highlighting the correlation between volcanic episodes, suppliers of nutrient-rich habitats, and the diversification of ostracods. Additionally, the reaction of faunal communities to a rapid and intense past environmental emergency could be crucial to reach a better understanding of the origin and organization of present-day ecosystems. This is particularly the case in a complex ecosystem such as the Antarctic seas, where many factors such as glacial and other oceanographic effects are present in tandem. The investigation of post-crisis ostracod fauna, which are by far the most prolific group of arthropods in the fossil record, can also represent one of the best possible keys to interpret the bio-reaction to past abrupt changes. In this sense, the impact of pyroclastic fall deposits, identified in two cores (ANTA02-NW1 and NW2) of Late Pleistocene-Holocene marine sediments from the northern Victoria Land Ross Sea, were studied in order to determine the recovery patterns of benthic ostracods and foraminifers. The studied levels of Core ANTA02-NW2 show a close correlation between the ash-fall deposited at 0-13, 213-230, 255-65 cm (Del Carlo *et al*. 2015) and the disappearance of ostracod fauna. The post-crisis ecosystem shows strong perturbations of their diversity and abundance for a long period of time, mainly in ash-fall from 213-230 cm. High diversification in the lower sediments (283-294 cm) of core ANTA02-NW2, situated above an ash fall layer, could be explained if the volcanic material provided nutrient-rich habitats for the development of a new population. These results show that in both core sediments, ash-falls lead to a marked rearrangement of assemblages and the extinction of some ostracod species, while less prominent volcanic episodes only result in temporary changes in the assemblage structure. Recovery follows several steps: Post-event ecosystem with 'survival faunas' (very low abundance; low diversity), few species (opportunistic taxa; e.g. *Cativella bensoni* Neale, 1967, *Cytheropteron* spp., *Pseudocythere* cf. *caudata* Sars, 1866) dominate the assemblage; Early stages of recolonization with 'recovery faunas' (increasing abundance and diversity; recolonization by pre-event and immigrant species). After a short "disturbance period", there is a return to "climax assemblages" with specialized taxa (high abundance; high diversity). Foraminifers, on the contrary, seem to be less sensitive than ostracods during volcanic episodes. Even if a significant decrease in their density was recorded, some foraminifer species, such as *Miliammina earlandi* and *Trifarina angulosa*, were able to survive even during the environmental crisis caused by the ash-fall deposition. These results also show that the manifold Antarctic environment taxa crises are not always indicators of glacial effects, and that a multidisciplinary approach is often necessary.

**A new genus of the tribe Zonocypridini (Crustacea, Ostracoda, Cypridopsinae) from Thailand**

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A new cypridopsine genus described here is principally characterized by the reduced caudal ramus (CR), the strongly serrated claw G2 of the antenna (A2), the undivided penultimate segment of the second thoracopod (T2), the complete septa on posteroventral margin and the incomplete septa on anterior margin of both valves. The new genus is placed in the tribe Zonocypridini Higuti & Martens, 2012 of the subfamily Cypridopsinae Kaufmann, 1900 and one new species is described as the type species of this new genus. Apart from the above generic characters, the tiny needlepoint-like pores along anterior and ventral margins of both valves are also typical of the new species. The presence of marginal septa in the new genus is a distinctive character and it is the first type these features are found in the Cypridopsinae. The genus *Pseudocypretta* Klie, 1932 (subfamily Cyprettinae Hartmann, 1971) is here allocated to the tribe Zonocypridini in the subfamily Cypridopsinae, because of its reduced CR and strongly serrated claw G2 of A2. A key to genera of the tribe Zonocypridini is provided.

## Cryptic species in *Cypridopsis vidua* (O.F. Müller, 1776)

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*Cypridopsis vidua* is one of the most abundant non-marine ostracod species. Here, we have extensively investigated populations in the North of Belgium for their morphological and genetic diversity to test for the presence of cryptic species. Based on DNA sequence data of the mitochondrial COI gene (also used for DNA barcoding) from more than 100 specimens, we identify three distinct phylogenetic clusters, which fulfil the criteria of the genetic species concept. Analysing valve outlines of the same specimens with Morphomatica does not reveal any match between morphological and genetic groups. We can thus conclude that the genetic species of *C. vidua* from Belgium are in fact cryptic species.

Additional DNA sequence data from Brazilian *C. vidua* specimens show that certain Brazilian specimens belong to genetic species from Belgium while others do not. Molecular screening of additional *C. vidua* from New Caledonia reveals that one groups of these ostracods is closely related to Brazilian specimens, while the second clusters with Belgian specimens but is genetically different. Also, these two groups fulfil the criteria of the genetic species concept.

So far, we have thus found five different genetic species of *C. vidua*: three from Belgium, one from Brazil-New Caledonia and one from New Caledonia. Our results illustrate that the genetic screening of additional specimens from other regions of the globe is required before we can draw final conclusions on the possible global or local distribution of genetic *C. vidua* species.

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# Horizontal gene transfer in the putative ancient asexual ostracod *Darwinula stevensoni*

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Darwinulid ostracods are one of the four remaining examples of putative ancient asexual animals (> 10 myr), among bdelloid rotifers, oribatid mites, and *Timema* stick insects. In the genomes of bdelloid rotifers ~8-10% of protein-coding genes originate from horizontally transferred genes of non-metazoan origin. Horizontal acquisition of foreign genes could thus be an important evolutionary mechanism in asexuals for adaptations in the absence of meiosis. In the LATTECO project, we are investigating horizontal gene transfer (HGT) in the ostracod *Darwinula stevensoni*. This is an excellent model species for investigating HGT because (1) it is a putative ancient asexual, (2) it hosts endosymbiotic *Cardinium* bacteria (Schön *et al*. 2019), which could facilitate gene transfer between bacteria and their ostracod hosts and (3) it is geographically widespread and has a wide ecological tolerance; HGT could have contributed to its ecological success.

The LATTECO project has applied two lines of genomic research to *D. stevensoni*. We have conducted high throughput sequencing of bacterial 16S to characterize the microbiome of this ostracod species in three different geographic locations. This will allow us to identify bacteria that could potentially have acted as donors for horizontal gene transfer. We have also screened three replicates of *de novo* transcriptomes of *D. stevensoni* obtained with RNA sequencing to identify genes with potential horizontal origin.

It is challenging to distinguish between genuine HGT and possible contamination as is evidenced by two studies on Tardigrada: the amount of horizontally transferred genes was first estimated as 1/6$^{th}$ of the genome (Boothby *et al*. 2015). Additional analyses revealed that the majority of these genes came from microbial contamination, and that the real frequency of HGT in the tardigrade genome was at most 1-2% (Koutsovoulos *et al*. 2016). Therefore, we have employed several strict filters in the LATTECO project to confirm genes that indeed originate from horizontal transfer. The last step of this process includes sequencing selected parts of a genomic cosmid library of *D. stevensoni*, which is currently ongoing. After all analyses have been conducted, we will have identified genes with HGT and their potential functional impact in the ostracod host *D. stevensoni*.

**Acknowledgements**
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## Survival rate of ostracods after exposure to freezing

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We performed experiments involving freezing ostracods at temperatures: -1, -2, -3, -5, -7°C. Ostracods were frozen for 24 hours. In additional experiment, ostracods were frozen for 7 days at -1°C. Ostracods were frozen in two variants: freezing in water and freezing on wet filter paper. Microclima Plant Growth Chambers from Snijders MC 1750 VHOE-EVD were used for experiments. Control samples were also carried out at 4°C. Ostracods for the experiment were collected in a small periodic pond in the Oder River valley (N-W Poland), in winter period. Before the experiment, ostracods were kept in water at 4°C for one week. Due to fact that *Cyclocypris laevis*, *Cypria ophtalmica*, *Fabaeformiscandona acuminata* and *F. hyalina* had sufficient representatives in the samples, they were used for comparision and statistical calculations. Other species like: *Candona neglecta*, *Candona weltneri*, juvenile Candoninae and juvenile *Pseudocandona* were excluded from analyzes because sporadical occurrence in the samples. In individual containers, more than 30 specimens were placed, all taxa were placed together. The survival rate in percent (survival) was calculated. The average survival rate of ostracods on wet paper and in water was respectively: for 4°C 89% and 95%, for -1°C 74% and 62%, for -2°C 23% and 67%, for -3°C 25% and 39%, for-5°C 5% and 9%, for -7°C 0% and 0%. The significance of the differences between the survival of the ostracods in the samples frozen on wet paper and water was examined using the Student's T-test. Significant differences were found only in samples frozen at -2°C and -5°C. For control samples held at 4°C, no significant differences in survival were found. The significance of differences between the survival rate of the ostracods in control samples held at 4°C and frozen at different temperatures on wet tissue and water was examined using the Student's T-test. In most cases, significant differences were found, no significant differences occurred only for samples frozen on the wet paper at -1°C and in water at -2°C. In order to find out how the ostracod species are grouping against the factor which is freezing, cluster analysis was performed according to the paired group algorithm with correlation similiarity. Two groups formed, the first included *F. acuminata* and *F. hyalina* whereas the other – *C. laevis* and *C. ophtalmica*. Survival rates for *C. laevis*, *C. ophtalmica*, *F. acuminata*, *F. hyalina* at -1°C were 80, 50, 70, 40%, respectively. When decreasing freezing temperatures, the survival rate of *C. laevis*, *C. ophtalmica*, decreased more than in *Fabaeformiscandona*, but at -5°C for all species it was similar, ranging from 2.5 to 3%. The survival rate at -1°C during one week was 43, 13, 2, 2%, respectively for above species. Extending the hibernation time from 24 hours to 7 days resulted in a significant reduction in survival, in most taxa the difference was over 36% and for *F. acuminata* it was 67%. It can be concluded that ostracods survived well at temperatures from -1 to -3°C (survival rate 23–74%). A survival rate significantly decreased at -5°C (survival rate 5–9%), and at minus 7°C ostracods did not survive at all. Extending the hibernation time significantly reduces survival. Extending the exposure time in -1°C did not cause differences in survival on wet paper and water. The survival rate of ostracods at different temperatures is different for individual taxa. At low temperatures (-5°C), ostracods better survived freezing in water than on wet paper.

**Environmental influences on ostracod assemblages in endorheic wetlands of the North West Province, South Africa**

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Despite increasingly recognized importance of temporary wetland ecosystems to regional biological diversity, their often highly specialized invertebrate communities are largely understudied. The semi-arid North West Province of South Africa comprises hundreds of shallow endorheic wetlands or pans, most of which dry up over winter. The present study aimed at determining taxonomic composition and dominance structure of ostracod assemblages and also at examining how basic environmental factors influenced these assemblages in endorheic lentic waters of the central part of the North West Province. A total of 16,632 specimens belonging to 12 species were collected from 18 study sites situated in 10 pans of diverse water chemistry and surface areas, including the largest Barberspan, an important Ramsar site. The most abundant species in the whole material were *Heterocypris giesbrechti* (41%) and *Plesiocypridopsis newtoni* (27%), both widely distributed across Sub-Saharan and North Africa. Some specimens were identified only to the genus level (*Potamocypris* and *Pseudocypris*) and left in open nomenclature as we expect them to be new to science. Based on zoocoenological classification and ordination analyses, two major assemblage types were distinguished: the assemblage type A with the largest contribution of *H. giesbrechti* and *P. newtoni* (67%) and the type B dominated by *Potamocypris mastigophora* (21%). Principal coordinate analysis showed that the taxonomic structure of these two assemblage types was significantly dependent on water electric conductivity. *Heterocypris giesbrechti* and *Plesiocypridopsis newtoni* prevailed in pans with higher conductivity of 1101-16760 μS/cm, whereas in waters of conductivity < 1123 μS/cm *Potamocypris mastigophora* was the most common. Separation of ostracod assemblages at two other sites was influenced by pH, indicating that water properties may be strong determinants of ostracod assemblage composition and structure in the studied pans. Identifying and understanding drivers of compositional structure of assemblages of ostracods and other invertebrates of temporary pans provides a baseline for further studies on anthropogenic impact assessment on these endangered and unpredictable ecosystems.

## Early Cretaceous non-marine ostracod biostratigraphy of northeast China

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Non-marine Early Cretaceous rocks bearing abundant coal and oil resources are widely distributed in northeast China. These sediments contain abundant non-marine ostracod fossils. Hou (1958) reported the first Early Cretaceous non-marine ostracod fossil from northeast China, numerous papers on Early Cretaceous ostracod taxonomy in this area have been published. These papers laid out the groundwork for ostracod biostratigraphy which was crucial to oil exploration on Lower Cretaceous sediments of northeast China during the 1980's. A number of taxonomic works on ostracod have been updated since the 1980's, while the Early Cretaceous non-marine ostracod biostratigraphy of northeast China has not been accordingly revised. On the basis of the updated ostracod taxonomy in northeast China, the non-marine ostracod biostratigraphy is reviewed here, and five ostracod assemblages are recognized.

a) *Luanpingella*-*Torinina*-*Daurina* assemblage indicating a Late Valanginian-Early Hauterivian age, is found in the lower part of the Dabeigou Formation of the Luanping Basin.
b) *Cypridea*-*Ziziphocypris*-*Timiriasevia* assemblage of the Late Hauterivian-Barremian age is mainly found in the upper part of the Dabeigou Formation (= Dadianzi Formation) of the Luanping Basin and in the Yixian Formation of western Liaoning.
c) *Scabriculocypris*-*Limnocypridea*-*Cypridea* assemblage approximates to the Aptian Stage and occurs in the Xiguayuan Formation of the Luanping Basin and in the Jiufotang Formation of the western Liaoning.
d) *Scabriculocypris*-*Mongolianella*-*Vlakomia* assemblage is tied to the Tongfosi Formation of the Yanji Basin, encompassing the Albian and ?Early Cenomanian stages.
e) *Mongolocypris*-*Yumenella* assemblage is found in the Late Albian - ?Early Cenomanian Dalazi Formation of the Yanji Basin.

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## *Candona rectangulata* Alm, 1914 as a palaeoclimatic indicator

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In literature *Candona rectangulata* is typically presented as a stenothermic species. It inhabited the Arctic during the Postglacial period, in agreement with hypotheses of species migration, as the climate was becoming warmer in the south. However, laboratory cultures conducted for 6 years at temperature ranges of 21-28°C and 13-28°C demonstrate that *C. rectangulata* is a eurythermic species. The species cannot be considered as cold-loving therefore its application to palaeoclimate research in the role of cold climate indicator is doubtful. The results point to a different conclusion, i.e., recent limitation in the area of *C. rectangulata* occurrence does not result from too high temperature outside the Arctic. Paradoxically, a lack of tolerance to low temperature and fast rate of the ice ↔ water phase transitions limit the occurrence of *C. rectangulata* to the Arctic region. The sub-Arctic area, with large amplitudes of temperature change resulting in local freezing, as well as a lack of insulating snow layers as thick as in the Arctic, will form a geographical range barrier.

Light is another factor that influences the geographical range of *C. rectangulata*. In total darkness, the species does not graze and although it can tolerate well the oxygen deficit, it will not be present in the profundal zone. As a result of its presence in the littoral or shallow basins, *C. rectangulata* is exposed to variable thermal conditions.

*Candona rectangulata* is a very good indicator for determining a mild climate without sudden temperature changes in the daily cycle (frozen – not frozen). Currently, this species occurs only in the littoral zone. Finding this species in Pleistocene sediments indicates shallow waterbodies or the littoral zone of deep lakes.

Analysis of the shell length of individual development stages indicates different characteristic courses for field conditions and laboratory cultures. Differences in variability result from periods of hibernation in Arctic conditions. The record of such variables in the analyzed historical data shows periods of complete freezing of the waterbody along with the sediment.

**Assessment of toxicity of contaminated bottom sediments using biotests based on stress reaction of *Heterocypris incongruens* and *Candona rectangulata***

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Rybnik reservoir (50°8’26’’ N, 18°29’51’’ E) is one of the largest reservoirs located in the area of Silesia (south-western Poland). The area of the reservoir is a highly industrialized region, the mining (hard coal), metallurgical (steel and non-ferrous metals), construction and transport as well as chemical industries concentrate here, which affects the pollution of bottom sediments.

In the toxicity study of bottom sediment samples taken from the Rybnik Reservoir, biotests were established based on the response to stress of invertebrates from various systematic groups, freshwater omnivorous (Crustacea, Ostracoda): *Heterocypris incongruens* (Ramdohr, 1808) (Ostracodtoxkit) and *Candona rectangulata* Alm, 1914 (CrecTest). Although both tests relate to sediment or water toxicity testing, their operation is based on different principles. This test was used to measure the mortality and growth inhibition of the crustacean *Heterocypris incongruens* hatched from cysts after six days of exposure to the sediment samples. After six days of contact with the sediment, the percentage mortality and growth of the crustaceans were determined and compared with the results obtained in the (non-toxic) reference sediment (Ostracodtoxkit F 2001; ISO 14371:2012). This test is used to test chronic toxicity. *Candona rectangulata* (Arctic ostracod with high resistance to various environmental factors including temperature) is used for analysis of toxicity of the tested water or sediments samples. In the tests, females in developmental stages A4 - A9 are used. The assessment of sediment toxicity is based on reactions of *C. rectangulata*: 1. normal behavior, 2. reduced life activity, 3. anabiosis, 4. lethal effect. Differentiated toxicity was found against the organisms from lack thereof to samples from high biological potential. Despite numerous similarities in the response of organisms, several time-related differences in organisms have been shown in studies. Nevertheless, both tests have a large application potential in the study of the quality of bottom sediments.

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**The interaction of new starch based polymer compositions with *Candona rectangulata* in biotest (CrecTest)**

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In order to analyze the interactions of aquatic living organisms in the presence of new starch based compositions (filaments or granulate shapes) biotests based on the response to the stress of the Arctic freshwater species *Candona rectangulata* Alm, 1914 (Crustacea, Ostracoda) were used. The granulate and filament were both obtained at GUT and the technological procedure was patented under EP3064542 number. Both materials were obtained from renewable raw materials and are compostable and biodegradable at particular conditions. Filament is based on potato starch while granulate is of potato and corn starch origin. There are sought to replace in future petrochemically-based non-biodegradable polymer products for single use. The test culture from *C. rectangulata* was carried out for 2 days (acute toxicity) and 20 days (chronic toxicity). In the tests, 10 specimens (A4 - A9) were used. Three repetitions were carried out for each test. During the test cultures there was a slow process of disintegration of the studied polymers, which became the basic food of *C. rectangulata*, more attractive than the previous natural food. No toxicity (acute or chronic) of test substances was found.

**Late Cretaceous-Early Paleogene biostratigraphy and stable isotopes of ostracod in the Songliao Basin, NE China**

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Songliao Basin was one of the largest non-marine rift basin during Cretaceous. Widespread deposits in the basin are mainly composed of clastic sediments which contain abundant ostracods and other fossils, such as gastropod, bivalves and vertebrates. These well preserved ostracod fossils provide us valuable information about Cretaceous climate changes and biotic responses in a greenhouse environment. The Cretaceous Continental Scientific Drilling in the Songliao Basin (SK1) offers a rare opportunity to study Late Cretaceous non-marine ostracod. The SK1 was drilled separately in two boreholes: the lower 959.55-meter-thick south core (SK1(s)), and the upper 1636.72-meter-thick north core (SK1 (n)), containing, in ascending order, the upper Quantou Formation, Qingshankou Formation, Yaojia Formation, Nenjiang Formation, Sifangtai Formation, Mingshui Formation and Taikang Formation.

A high-resolution non-marine ostracod biostratigraphy based on SK1 has been established. A total of 80 species belonging to 12 genera in the SK1(s) and 45 species assigned to 20 genera in the SK1(n) have been identified. Nineteen ostracod assemblage zones have been recognized from upper Quantou Formation to Mingshui Formation: 1. *Mongolocypris longicaudata-Cypridea* Assemblage Zone, 2. *Triangulicypris torsuosus-Triangulicypris torsuosus nota* Assemblage Zone, 3. *Cypridea dekhoinensis-Cypridea gibbosa* Assemblage Zone, 4. *Cypridea nota-Sunliavia tumida* Assemblage Zone, 5. *Cypridea edentula-Lycopterocypris grandis* Assemblage Zone, 6. *Cypridea fuyuensis-Triangulicypris symmetrica* Assemblage Zone, 7. *Triangulicypris vestilus-Triangulicypris fusiformis-Triangulicypris pumilis* Assemblage Zone, 8. *Cypridea panda-Mongolocypris obscura* Assemblage Zone, 9. *Cypridea exornata-Cypridea dongfangensis* Assemblage Zone, 10. *Cypridea favosa-Mongolocypris tabulata* Assemblage Zone, 11. *Cypridea formosa-Cypridea sunghuajiangensis* Assemblage Zone, 12. *Cypridea anonyma-Candona fabiforma* Assemblage Zone, 13. *Cypridea gracila-Cypridea gunsulinensis* Assemblage Zone, 14. *Mongolocypris magna-Mongolocypris heiluntszianensis* Assemblage Zone, 15. *Cypridea liaukhenensis-Cypridea stellata* Assemblage Zone, 16. *Ilyocyprimorpha-Limnocypridea sunliaonensis-Periacanthella* Assemblage Zone, 17. *Strumosia inandita* Assemblage-Zone, 18. *Talicypridea amoena-Metacypris kaitunensis-Ziziphocypris simakovi* Assemblage Zone, 19. *Ilyocypris* Assemblage Zone. Assemblage Zones 1 to 18 span late Cretaceous, while 19 Assemblage Zone might span the latest Maastrichtian to the earliset Danian.

The stable oxygen and carbon isotopes of the ostracod shells from the Sifangtai Formation and Mingshui Formation were tested. Oxygen isotope ratios ranged from -13.5‰ to ~-4‰, and those of carbon isotopes from -7‰ to ~0‰. Correlations between oxygen and carbon isotopic ratios suggest an open freshwater lake during sedimention of the Sifangtai and Mingshui Formations. The values of oxygen and carbon isotopes fluctuated greatly from the Sifangtai to the Mingshui Formation, suggesting that paleoenvironment and paleoclimate of the Songliao Basin changed dramatically throughout late Campanian to early Danian.

# An enigmatic gigantic marine ostracod trapped in Burmite (mid-Cretaceous amber of Myanmar)

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The Burmese amber (or 'Burmite', ~99 Ma, Myanmar) is widely known for exquisite preservation of a mid-Cretaceous terrestrial fauna including dinosaur remains and birds but also yields marine fossils and microfossils which provide important contextual information on palaeoenvironment and amber formation. The first Cretaceous ostracod recorded in amber (Xing *et al*. 2018) is a 'gigantic' representative of the exclusively marine group Myodocopa. Subsequent resin flows in the amber specimen, containing terrestrial arthropods and insect frass, resolve an enigmatic taphonomic pathway.

Ostracods are rarely encountered in amber, and the few examples known derive from Eocene and Miocene amber deposits. Our first finding of a right valve of a 'gigantic' (12.9 mm) marine ostracod in a specimen of Burmese amber effectively doubles the age of the oldest ostracod amber record but also offers the first representative of the subclass Myodocopa (Ordovician to Recent), an exclusively marine and weakly calcified group with a poor fossil record, in amber. However, the lack of soft parts and the complementary left carapace valve combined with many unspecific valve features and presumed morphological stasis, restrict our inferences at lower taxonomic level.

The amber that constitutes our specimen was produced under two distinct sets of conditions. The resin flow that contains the ostracod is relatively clear whereas the subsequent resin flow in the amber specimen contains terrestrial arthropods (spider fragments) and multiple dark particles of insect frass. The prominent drying surface line between the flows has been distorted due to flow around the ostracod valve while the resin was still pliable, and tears and cracks within the surface indicate oxidation and partial polymerization before the second resin flow was added. The combination of 'marine' and terrestrial resin flows may have been brought about by variation in water levels, a mechanism proposed in the study of modern marine organisms preserved in resin and invoked for other Cretaceous ambers with marine contents. While many sites of the mid-Cretaceous Burmese amber exhibit marine influences (marine fossil content), full palaeoenvironmental and geological details for the numerous amber-producing sites in the Kachin state of Myanmar have yet to be reported.

In addition to its significance of the Burmese amber deposits as important archive for mid-Cretaceous terrestrial life and biodiversity, our find of the oldest ostracod preserved in amber being related to a marine group with a poor fossil record emphasizes the significance and further potential of these deposits as archive for marginal marine life and biodiversity.

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# WORKSHOPS

## Ostracoda in Environmental Micropalaeontology

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As we all know Ostracoda are excellent tools in palaeoecology and ecology. They react sensibly to changes in the environment by assemblage and population structure, morphology and shell chemistry. This is true for anthropogenic impacts as well as demonstrated in many studies – eutrophication, heavy metal contamination, oil spills and changes in sedimentation rates are amongst anthropogenic disturbances indicated by ostracods and published already. Nevertheless, ostracods are not a part of bio-monitoring schemes so far. This is different for another classical microfossil group, Foraminifera. For them, the concerted efforts of the FOBIMO protocol and the FRESCO consortium push bio-monitoring since 2011. Benthic Foraminifera are already established in marginal marine water quality monitoring in Norway. So, our colleagues from foraminiferology are a step ahead in this field compared to us in ostracodology.

Why, Ostracoda in water-quality monitoring and related studies in environmental micropalaeontology? Species specific reactions to environmental factors and short life cycles ensure high temporal resolution in documenting anthropogenic impacts. Their small size needs small samples only, thus minimizing disturbance and sampling efforts, especially in coring. Wide distribution and often high abundance allow to use them in most aquatic environments. Their calcitic shells are easy to preserve in most geo-archives and allow historical comparisons or reconstruction of reference conditions. All this can be done relying on Foraminifera as well, but ostracods are known to give more detailed insights in some respects (e.g., hydrocarbon pollution, water chemistry) making a combined approach of both groups interesting. Furthermore, foraminifers, being a marine group, drop significantly in diversity and abundance with decreasing salinity until they are not only complemented but replaced by ostracods in estuarine systems or beyond in continental waters. The literature concerning ostracods as tool for biomonitoring is, however, still scarce and scattered on smaller studies to have a holistic picture of their effectiveness.

We give a short overview about the research field and published studies in environmental micropalaeontology based on Ostracoda in order to demonstrate potential applications of ostracods and ask you, the participants, to give short (up to 5 min) presentations from your own work if applicable. Based on this overview, we would like to discuss with you how we could start concerted efforts to establish ostracods as bio-indicators in water quality monitoring in marginal marine and continental waters. This concerns standardised methods, cooperative research and long-term programmes.

Let us promote ostracods in environmental micropalaeontology and especially as bio-indicators in water quality monitoring to strengthen our discipline and, if established in monitoring schemes, even creating new positions for young scientists. Ostracods can deliver more than being just palaeoclimate proxies and biostratigraphic index fossils, they have the potential to serve as tools in helping to protect our environments.

**African Ostracod Taxonomy**

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This is a hands-on workshop open to all colleagues working or intend to work on Afrotropical, non-marine ostracods from Neogene to Quaternary sequences. In the past decades, the number of Neogene and Quaternary palaeoenvironmental studies in Africa increased promisingly. Several lacustrine archives were analyzed in multi-disciplinary projects using various proxies including ostracods. Likewise, modern studies increased in numbers and document the diversity of the extant African ostracod fauna that resulted in proposing new species. As seen in other geographical areas, it is of uttermost importance to work on taxonomic harmonization, which is understood as a joint effort of all actively involved working groups. The aim of the workshop is the identification of Afrotropical species or higher taxa level with known conflicts in nomenclature. Further, existing species lists are reviewed and special emphasis is put on taxa descriptions with wide biogeographical ranges and potential indicator value for (paleo-)ecological studies.

The participants are encouraged to discuss their findings based on their own material (images or originals). Eventually, it is planned to establish a collaborative online space with controlled access to stimulate discussions after the workshop and initiate a series of future workshops.

# POST-CONFERENCE FIELD TRIP
## AN OVERVIEW OF OSTRACOD FAUNA

This two-day trip provides an overview on various coastal and inland landscapes and hydrobiological settings in the vicinity of Gdańsk.

### 1. Ostracods from interstitial waters of the Baltic sandy shores of the Hel Peninsula and of shallow brackish waters of the Bay of Puck

The Hel Peninsula is a long and narrow sandbar which separates the Bay of Puck (an inner part of the Gulf of Gdańsk) from the Baltic Sea proper and was formed by the deposition of sandy sediment by the sea current. Crustaceans (copepods and ostracods) inhabiting subterranean waters of the open coast and more protected areas were studied by Sywula (1982). Typically for such habitat crustacean diversity and abundance was very low. Besides single stygobiont and stygophile harpacticoid copepods, seven species of ostracods were found but only stygoxenes or accidental species from neighbouring areas.

**List of ostracod species found in interstitial waters of sandy shores of the Hel Peninsula**

*Cyprideis torosa* (Jones, 1850)
*Cytheromorpha fuscata* (Brady, 1869)
*Cytherura gibba* (O. F. Müller, 1785)
*Elofsonia baltica* (Hirschmann, 1909)
*Leptocythere* sp.
*Limnocythere inopinata* (Baird, 1843)
*Xestoleberis aurantia* (Baird, 1838)

Recent ostracods of the inner part of the Gulf of Gdańsk (the Bay of Puck) were described by Sywula (1966) and Oleńska & Sywula (1988). On sandy bottom down to the depth of 5 m the latter authors found 16 species (including two rare or poorly known *Leptocythere psammophila* Guillaume, 1976 and *Microcytherura affinis* Klie, 1938) and distinguished four assemblages.

1) Assemblage of purely sandy bottom with *Cytherura gibba* as a dominant species.

2) Assemblage of sandy bottom and strong water movement where *Elofsonia baltica* was the key species.

3) Assemblage inhabiting sandy bottom with rich organic debris dominated by *Leptocythere lacertosa* (Hirschmann, 1912) and *Cytherura gibba*.

4) Assemblage of sandy bottom with organic debris situated off mouths of streams and rivers in which four species were the most important: *Cyprideis torosa*, *Leptocythere lacertosa*, *Cytherura gibba* and *Cytheromorpha fuscata*.

Distribution of ostracods in Late Glacial to Holocene of the Gulf of Gdańsk was summarised by Krzymińska & Namiotko (2013). These authors revealed successional succession of ostracods in which initial (Late Glacial-early Holocene) palaeoassemblages, dominated by inhabitants of the deep bottom zones of modern oligo-mesotrophic lakes, were replaced in the middle and late Holocene by the assemblages of brackish water species when marine waters entered the Baltic basin and caused the major hydrological shift from the freshwater system into the brackish-marine Littorina Sea.

### 2. Ostracods of the Słowiński National Park

Słowiński National Park covers ca. 327 $km^2$ of the middle part of the Polish Baltic Sea coast. It was founded to protect coastal lakes and various wetland areas (ponds, swamps, and peatbogs) as well as seaside forest and the largest moving sand dunes in Europe. High value of natural habitats and beauty of the Park has acquired international recognition proved by its inscription on various lists of the international network of protected areas, such as the UNESCO Biosphere Reserves or Ramsar Wetlands of International Importance (https://slowinskipn.pl/en). Studies on recent ostracods of the Park have been initiated by the M.Sc. project of K. Talkowska supervised by T. Sywula and T. Namiotko (Talkowska 1999 unpubl.). More than 22 thousand of specimens belonging to 35 species were collected from various habitats of the Park area, including four coastal lakes (Gardno, Łebsko, Dołgie Wielkie and Dołgie Małe), ponds and oxbow lakes, small permanent waterbodies as well as small temporary wetlands of raised bogs and fens.

**List of recent Ostracoda of the Słowiński National Park**

| Species | Lake Gardno | Lake Łebsko | Lake Dołgie Wielkie | Lake Dołgie Małe | Ponds and oxbow lakes | Small permanent waterbodies | Temporary wetlands of rised bogs | Temporary wetlands of fens |
|---|---|---|---|---|---|---|---|---|
| *Bradleystrandesia reticulata* (Zaddach, 1844) | | | | | | X | | |
| *Candona angulata* G.W. Müller, 1900 | X | X | | | | | | |
| *Candona candida* (O.F. Müller, 1776) | X | X | X | X | X | X | X | |
| *Candona neglecta* Sars, 1887 | X | X | X | | X | | | |
| *Candona sanociensis* Sywula, 1971 | X | | | | | | | |
| *Candona weltneri* Hartwig, 1899 | X | X | | | X | | | X |
| *Candonopsis kingsleii* (Brady & Robertson, 1870) | X | | X | | X | X | | X |
| *Candonopsis scourfieldi* Brady, 1910 | | | | | | | | X |
| *Cyclocypris ovum* (Jurine, 1820) | X | | X | | X | X | | |
| *Cypria exsculpta* (Fischer, 1855) | | | X | | | X | | X |
| *Cypria ophtalmica* (Jurine, 1820) | | X | X | X | X | X | X | X |
| *Cyprideis torosa* (Jones, 1850) | X | X | X | X | X | X | X | X |
| *Cypridopsis vidua* (O.F. Müller, 1776) | X | X | X | X | X | X | X | |
| *Cytheromorpha fuscata*(Brady, 1869) | X | X | | | X | | | |
| *Darwinula stevensoni* (Brady & Robertson, 1870) | X | X | X | X | X | | | |
| *Dolerocypris fasciata* (O.F. Müller, 1776) | X | | X | | | | | |
| *Fabaeformiscandona acuminata* (Fischer, 1851) | | X | X | | X | X | X | |
| *Fabaeformiscandona alexandri* (Sywula, 1981) | X | X | | | | | | |
| *Fabaeformiscandona caudata* (Kaufmann, 1900) | | | | X | | | | |
| *Fabaeformiscandona fabaeformis* (Fischer, 1851) | X | | | | | | X | X |
| *Fabaeformiscandona fragilis* (Hartwig, 1898) | X | | | | | | X | X |
| *Fabaeformiscandona levanderi* (Hirschmann, 1912) | X | X | | | | | X | |
| *Fabaeformiscandona protzi* (Hartwig, 1898) | X | X | X | | | | | X |
| *Herpetocypris reptans* (Baird, 1835) | X | X | | | | | | |
| *Ilyocypris decipiens* Masi, 1905 | X | X | | | | | | |
| *Isocypris beauchampi* (Paris, 1920) | X | | | | | | | |
| *Limnocythere inopinata* (Baird, 1843) | X | X | | | | | | |
| *Limnocythere sanctipatricii* (Brady & Robertson, 1869) | X | | | | | | | |
| *Potamocypris smaragdina* (Vávra, 1891) | X | X | | | | | | |
| *Potamocypris unicaudata* Schäfer, 1943 | X | X | | | | | | |
| *Potamocypris variegata* (Brady & Norman, 1889) | X | | | | | | | |
| *Pseudocandona albicans* (Brady, 1864) | | | | | X | | | |
| *Pseudocandona compressa* (Koch, 1838) | X | X | X | X | X | X | | X |
| *Pseudocandona insculpta* (G.W. Müller, 1900) | | X | | | | | | |
| *Pseudocandona lobipes* (Hartwig, 1900) | X | X | | | | | | X |

Distribution of Ostracoda in Late Glacial and Holocene sediments of the Słowiński National Park was studied by Brodniewicz & Rosa (1967) – one Holocene (Littorina Sea) profile at Czołpino, Brodniewicz (1972) – one Holocene profile at Brenkowo, and Zawadzka *et al*. (2005) – one profile of Late Glacial-Holocene from the sea bottom off Lake Łebsko. In total 25 species were recorded of which only four were inhabitants of marine or brackish waters.

**List of Late Glacial and Holocene Ostracoda of the Słowiński National Park**

| Species | Brodniewicz & Rosa (1967) | Brodniewicz 1972 | Zawadzka *et al.* (2005) |
|---|---|---|---|
| *Candona angulata* G.W. Müller, 1900 | | | |
| *Candona candida* (O.F. Müller, 1776) | | | |
| *Candona neglecta* Sars, 1887 | | | |
| *Cyclocypris laevis* (O.F. Müller, 1776) | | | |
| *Cyclocypris ovum* (Jurine, 1820) | | | |
| *Cypria ophtalmica* (Jurine, 1820) | | | |
| *Cyprideis torosa* (Jones, 1850) | | | |
| *Cypridopsis vidua* (O.F. Müller, 1776) | | | |
| *Cytherissa lacustris* (Sars, 1863) | | | |
| *Cytheromorpha fuscata*(Brady, 1869) | | | |
| *Cytherura gibba* (O.F. Müller, 1785) | | | |
| *Darwinula stevensoni* (Brady & Robertson, 1870) | | | |
| *Herpetocypris reptans* (Baird, 1835) | | | |
| *Heterocypris salina* (Brady, 1868) | | | |
| *Ilyocypris decipiens* Masi, 1905 | | | |
| *Ilyocypris gibba* (Ramdohr, 1808) | | | |
| *Ilyocypris lacustris* Kaufmann, 1900 | | | |
| *Limnocythere inopinata* (Baird, 1843) | | | |
| *Limnocythere sanctipatricii* (Brady & Robertson, 1869) | | | |
| *Metacypris cordata* (Brady & Robertson, 1870) | | | |
| *Pseudocandona compressa* (Koch, 1838) | | | |
| *Pseudocandona rostrata* (Brady & Norman, 1889) | | | |
| *Sarscypridopsis aculeata* (Costa, 1847) | | | |
| *Semicytherura nigrescens* (Baird, 1838) | | | |
| *Xestoleberis aurantia* (Baird, 1838) | | | |

## 3. Recent and subfossil ostracods of channel postglacial Lakes Raduńskie

Upper and Lower Lakes Raduńskie are situated in the Kashubian Lake District within the Kashubian Landscape Park, ca. 40 km south-west of Gdansk. These are classical postglacial channel lakes with considerable depth and complex basin morphology. Lower Raduńskie lake covers 737 ha and has a maximum depth of 35.4 m, whereas Upper Raduńskie – 387 ha and 43.0 m, respectively. Holocene, subrecent and living ostracods of Lakes Raduńskie were studied by Sywula & Pietrzeniuk (1989, 1995) and Namiotko & Sywula (2005). The authors list a total of 26 species, including rare lacustrine species indicative of low trophy level: *Cytherissa lacustris*, *Limnocythere sanctipatricii* and *Fabaeformiscandona levanderi*. Distribution of valves in short sediment cores recovered from the profundal and sublittoral zones shows succession of ostracod assemblages. High abundance of *Candona neglecta* and *Fabaeformiscandona protzi* in the basal sediment layers is followed by high dominance of *Candona candida*, an increase of eurytopic species and an extinction of *Cytherissa lacustris* in the uppermost sediment layers. This may be explained by recent changes in trophic conditions of the lakes.

**List of subfossil (Holocene) and living ostracod species of Lakes Raduńskie**

*Candona candida* (O.F. Müller, 1776)
*Candona neglecta* Sars, 1887
*Candona weltneri* var. *obtusa* G.W. Müller, 1900
*Cyclocypris globosa* (Sars, 1863)
*Cyclocypris laevis* (O.F. Müller, 1776 )
*Cyclocypris ovum* (Jurine, 1820)
*Cyclocypris serena* (Koch, 1838)
*Cypria ophtalmica* (Jurine, 1820)
*Cypridopsis vidua* (O.F. Müller, 1776)
*Cytherissa lacustris* (Sars, 1863)
*Fabaeformiscandona alexandri* (Sywula, 1981)
*Fabaeformiscandona levanderi* (Hirschmann, 1912)
*Fabaeformiscandona fabaeformis* (Fischer, 1851)
*Fabaeformiscandona hyalina* (Brady et Robertson, 1870)
*Fabaeformiscandona protzi* (Hartwig, 1898)
*Herpetocypris reptans* (Baird, 1835)
*Limnocythere inopinata* (Baird, 1843)
*Limnocytherina sanctipatricii* (Brady et Robertson, 1869)
*Physocypria kraepelini* G.W. Müller, 1903
*Potamocypris* sp.
*Pseudocandona compressa* (Koch, 1838)
*Pseudocandona hartwigi* (G.W. Müller, 1900)
*Pseudocandona insculpta* (G.W. Müller, 1900)
*Pseudocandona lobipes* (Hartwig, 1900)
*Pseudocandona marchica* (Hartwig, 1899)
*Pseudocandona pratensis* (Hartwig, 1901)

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# NOTES

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