Abstracts

8th European Ostracodologists' Meeting

Tartu, Estonia, 22-30 July 2015

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Department of Geology, Institute of Ecology and Earth Sciences, University of Tartu

Edited by
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The meeting was organized by the Department of Geology, University of Tartu by:
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Preface

The ostracod workers are meeting regularly in different places of Europe but this is the first time when the meeting takes place in Estonia. Tartu, the location of the 8th European Ostracodologists' Meeting was decided during the 7th EOM in Graz, Austria, in the summer of 2011. The meeting is hosted by the Department of Geology of the University of Tartu.

The meeting is held in July 22-30, 2015 and the period is divided into three parts. The pre-conference field trip starts from Tallinn on July 22th and takes a small group of people to a number of sites related to the ostracod studies in Estonia. The scientific sessions in Tartu areheld from July 24th to 27th, with the mid-conference excursion to the Endla Nature Reserve and inter-drumlin Lake Saadjärv. The post-conference excursion visits the Ordovician and Silurian sections on the Island of Saaremaa and in mainland Estonia, it departs from Tartu on July 28th and terminates in Tallinn on July 30th.

The present abstract volume was prepared for the meeting. 40 talks and 34 poster presentations of this meeting summarize recent advances in ostracod studies, covering a wide range of topics from biology to geoarchaeology. Several business meetings are held during conference.

The organizers thank all contributors and members of the scientific committee and acknowledge financial support from the University of Tartu.

Tõnu Meidla and Oive Tinn

On behalf of the Organizing Committee

Ecology, diversity and a/sexual populations of non-marine ostracods in Muğla, Turkey

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In Turkey, 52% of the non-marine ostracods include sexual (males present) species. This ratio is relatively higher than European ostracods. Thus, in order to question for the possible reasons for this ratio and inquire into the question of "Why are there so many bisexual populations in Turkey?", we visited 68 sites with 15 different types of aquatic bodies in Muğla, a city located on the south-west corner of Turkey, during July of 2014. A total of 30 species (25 living) were found of which 11 species (*Candona weltneri*, *Psychrodromus fontinalis*, *Heterocypris barbara*, *Ilyocypris gibba*, *I. hartmanni*, *Limnoctyhere inopinata*, *Potamocypris arcuata*, *P. producta*, *P. unicaudata*, *P. villosa*, *Trajancypris leavis*) were new reports for Muğla. By these finding, the number of living ostracod species (i.e., gamma diversity) is increased to 49 species in Muğla. The ratio of bisexuals (68%) was found to be higher than the ratio of Turkey. Males of *P. fontinalis* were found as new for the Turkish ostracod fauna. Also, we found sexual populations of *P. olivaceus* and *P. fontinalis* from the same sampling site. Comparing the numbers of a/sexual species with and without swimming setae on A2 revealed that there were 16 and 20 species in artificial (e.g., trough, dam, canal etc.) and natural habitats (e.g., lake, spring, creek etc.), respectively. 10 of 16 species are sexual when six species were parthenogenetic in artificial habitats. 12 of 16 species carried swimming setae when four species had no setae. In contrast, we found 14 sexual and six parthenogenetic species in natural habitats. Of which, 11 and nine species were found with and without swimming setae. However, we did not find significant differences in the numbers of species in a/sexual populations with and without swimming setae and species abundance (numbers of individuals) in natural and artificial habitats (F-test: $p>0.05$) where 66% of the similarity was found between both types of habitats. According to Canonical Correspondence Analysis, 78% of the correlation between species and environmental variables was explained when water temperature was the most effective factor on species ($p<0.01$). Spearman correlation analyses exhibited a negative correlation between *H. salina* and *P. olivaceus* and *P. fontinalis* where the correlation was positive with *I. bradyi* ($p<0.01$). Similarly, *P. fontinalis* showed a negative correlation with *L. inopinata*. On the other hand, *C. torosa* and *P. variegata* showed strong and significant positive and negative correlations to the Ca and Mg levels of the water bodies ($p<0.01$), respectively. Results correspond to the tolerance and optimum values of individual species. Accordingly, our results do not provide a clear answer for the question asked above but different possibilities (ecological, historical, biological) are discussed.

Ostracoda as indicators of subaqueous sediment transport – a case study of turbidite and debrite deposites from Tangra Yumco, Tibetan Plateau

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We test a conceptual model on subaqueous mass transport to evaluate the distribution of ostracods within lacustrine event layers. The formation of sediment patterns and response of ostracods in subaqueous sediment transport within a large deep basin, Tangra Yumco on the southern Tibetan Plateau, Centra Asia, is presented.

Tangra Yumco (4595 m a.s.l., 30°45′ – 31°22′N and 86°23′ – 86°49′E) is one of the largest brackish lakes (surface area 818 km^2) on the Tibetan Plateau and the second deepest lake (230 m) in China. A 163 cm long core of Holocene sediments was retrieved at 220 m water depth from the centre of the northern part of Tangra Yumco. The northern basin is characterised by steep slopes especially on the eastern margin.

The sediment core was described using multi-proxy methods (magnetic susceptibility, X-ray images, mineralogy, texture, high-resolution granulometry and ostracod analysis regarding abundance, adult/juvenile ratio and proportion of carapaces) sampled in 1 cm intervals. Five event layers were documented: (i) Four relatively thick (between 2 and 12 cm) turbiditic layers with high magnetic susceptibility and graded bedding are classified as turbidite deposits and (ii) a thinner layer classified as debris deposit. The sedimentary features characterise subaqueous gravity flows and redeposition in a deep lacustrine environment of a large lake.

Our conceptual model of ostracod distribution in turbidite layers has the following assumptions: (i) a low abundance of ostracods within the event layers compared to the underlying and overlying sediments; (ii) a sharp decrease in the abundance of ostracods from the base of the event layers; (iii) a low adult/juvenile-ratio within the event layers; (iv) recolonization of the new substrate indicated by an increase in the number of carapaces in the uppermost part of the event layers; and (v) 'exotic' (allochthonous shallow water) ostracods within the event layers. The assumptions of the model could be confirmed by our findings. However, there are some differences: (i) a lower number of carapaces within the event layers, (ii) a lower number of adult valves within the event layers than predicted and (iii) absence of allochthonous shallow water ostracods within the event layers. The first two differences may be due to relatively low overall ostracod numbers counted. The third contradiction can be explained by a hypolimnic origin of the redeposited sediment in our material. This explanation is supported by the homogenous event layers indicating a distal origin of the sediment. Ostracod associations from debris flows are characterised by (i) absence of recolonization of overlying layers by pioneer assemblages and (ii) a relatively high ostracod abundance within a debris deposit compared to turbidites.

We conclude that ostracod evidence is a useful proxy for identification of depositional events (e.g., turbidites and debris flow) originated from lacustrine subaqueous sediment flows.

A late Quaternary lake level curve for Taro Co, Tibetan Plateau, based on ostracod analysis and OSL dating

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Taro Co, located on the Tibetan Plateau, is a large currently terminal lake with an area of 489 km^2 at an altitude of 4570 m asl. It has a maximum water depth of 132 m. We reconstruct the Quaternary lake level changes in the catchment of Taro Co, including Lake Zabuye, and use data by Lee (2008) from adjacent Lagkor Co. For this, a micropaleontological analysis combined with OSL and supporting radiocarbon dating in 16 outcrop samples and of a short sediment core from Taro Co was carried out. Ostracod analysis comprises quantitative documentation of associations including an assessment of the juvenile/adult ratio. Ostracod-based transfer functions for specific conductivity and water depth are applied for assessing lake volume changes. The degree of noding of *Leucocytherella sinensis* valves was used to infer salinity changes.

In the sediment core of 122 cm length, a total of seven ostracod species were detected with *L. sinensis* as dominant species and subsequently *Candona xizangensis, Leucocythere*? *dorsotuberosa*, and *Fabaeformiscandona gyirongensis*. Only in few samples and with low percentages *Tonnacypris gyirongensis, Limnocythere inopinata* and *Ilyocypris* sp. were found. The fauna from the outcrops is very similar, with only the species *T. gyirongensis* absent and with a low percentage of individuals of *Heterocypris salina*. Very low quantities of plant remains, chironomid larvae head capsules, shells of *Radix* sp. and invertebrate eggs were found in the short core as well as in the outcrops.

The synthesis of ostracod-based environmental reconstruction and OSL-based chronology, for samples from Taro Co and Zabuye Lake and adjacent Lagkor Co (Lee, 2008), reveals the evolution of the lake system during the past 40 ka. Results indicate a wet period at 36 ka followed by a dry phase around 20 ka. The Holocene moisture availability is characterized by an early Holocene lake level highstand forming one vast lake covering all three lake basins. A second maximum occurs between 5.5 and 3.4 ka and a last minor one at 1.1 ka. The present-day lake level of Taro Co is the lowest of the entire Holocene. This multi-proxy approach proved to be valuable for a synthesis of chronological timeframe, palaeoenvironmental reconstruction and morphological data resulting in estimations of lake volume changes. Such changes are indicators of climatic conditions, especially monsoonal influence.

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Repeat colonisation of temporary water-bodies by Early Carboniferous ostracods and bivalves

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The TW:eed Project investigates the rebuilding of Carboniferous ecosystems following the end Devonian mass extinction. New fossils populate ‘Romer’s Gap’ with a diversity of tetrapods, fish (gyracanthids, lungfish, rhizodonts, actinopterygians and chondrichthyans), invertebrates (malacostracans, eurypterids, scorpions and myriapods) and plants. The fossil-bearing Tournaisian Ballagan Formation was deposited on an extensive low relief, alluvial, vegetated floodplain, with a connection to marine waters. Bivalves and ostracods are the most numerous invertebrates in the formation; in the 502 metre thick Norham Core bivalves occur in 180 horizons, ostracods in 137 horizons and they co-occur in 50. Two types of assemblage are present. Type 1: Euryhaline to brackish bivalves (*Modiolus* and *Naiadites*) occur with ostracods (*Shemonaella, Paraparchites, Cavellina* and *Glyptolichvinella* being the most common) and an associated fauna of actinopterygian fish, and rarer lungfish, rhizodonts, eurypterids and gastropods. This assemblage occurs within sandstones, grey, black and brown siltstones, and microconglomerates interpreted as floodplain deposits. Type 2: *Beyrichiopsis* and unidentified thick-shelled ostracods occur with *Serpula*, thick-shelled bivalves, rare orthocone fragments and rare chondrichthyans. This assemblage occurs within dolomitic cementstones (interpreted as saline-alkaline lake deposits) and bioturbated grey siltstones (interpreted as the deposits of marine transgressions). Assemblage type 1 is most common, and the majority of the floodplain sediments overlie palaeosols or desiccation cracks, indicating the repeated occupation of temporary pools and lakes after periods of desiccation. The ostracod assemblages include a range of adult and juvenile stages, but most of the bivalve specimens are juveniles, indicating short-lived aquatic environments. The links between Early Carboniferous fish, bivalves and ostracods are explored in terms of their transportation into these temporary environments and food webs.

Effect of strong electric field (13.5 kV/m, 50 Hz) on life history characteristics of a cosmopolitan non-marine ostracod morphospecies *Heterocypris incogruens*

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As a result of the increased use of electricity and the considerable long distances between energy production and consumption, a grid of new high-voltage overhead transmission power lines in Europe is going to expand dramatically, covering and crossing a substantial number of habitats, including priority areas for wetland conservation. The possible adverse biological effects on humans and agricultural or laboratory animals due to exposure to the 50-60 Hz intense electric field (EF) generated by transmission lines have been of concern for over four decades, however the results of the previous studies have been yet inconclusive or controversial due to the limited validity for some methodological reasons. Indirect and/or cumulative impacts of power lines on freshwater biodiversity have been also poorly addressed, and virtually nothing is known about how EF generated by power wires may directly influence life history characteristics of freshwater invertebrates.

The present study is aimed at verifying whether there are any adverse or beneficial effects of the EF exposure on life history characteristics of a cosmopolitan non-marine ostracod morphospecies *Heterocypris incogruens* (individuals from a stock culture originated from an all-female population from Punta Arenas, S Chile) grown and hatched under laboratory conditions (25°C, 16 h light per day) mimicking strong EF (13.5kV/m, 50 Hz, 20 h exposure per day) generated by transmission lines (EF treatment) vs. control conditions (non-EF treatment). The experiment was started from early juveniles and here we present results obtained during a period of 38 days when females of the first generation matured (and/or died), laid their egg clutches and neonates of the second generation hatched. Ostracods were cultured individually in 6-well plates with 10 ml of mineral water and fed a combination of green algae (*Scenedesmus* sp.) and spinach served as both food and surface for grazing and lying eggs. Medium was renewed three times a week, and all wells were checked daily for moults, eggs and hatchlings. To test the hypothesis of no significant effects of EF on fitness components, differences of a number of life history traits between the EF and non-EF treatments were analysed: 1) development time from 3rd juvenile stage to adult female, 2) survival rate of juveniles, 3) life span of adult females, 4) survival curves of females, 5) fraction of females that laid eggs, 6) average fecundity as a mean egg number per female that laid at least one egg, 7) mean juvenile number per female that laid at least one egg, 8) mean hatching success per female.

The mean values of the traits 1), 2) and 7) as well as the shape of the survival curves 4) were nearly the same for the two experimental treatments. In the control conditions the mean of the life span of adult females (trait 3) as well as the fraction of females that laid eggs (trait 5) and their average fecundity (trait 7) were higher than those in the EF treatment (14.4 vs. 11.2; 71.4% vs. 58.3%; and 51.8 vs. 34.8, respectively), although the differences were not statistically significant. On the contrary, the mean hatching success per female that laid eggs was significantly higher in the EF treatment (76.2%) as compared with the control (59.7%). However, it remains unresolved, whether the reduced hatching success in the non-EF treatment resulted from higher fraction of resting eggs than in the EF treatment or indeed in the latter conditions females had higher reproductive success. Further long-term experiments need to be designed to test other specific hypotheses and to clarify the results obtained so far.

Calibration of past environmental conditions based on trace element composition of ostracod shells from the Tibetan Plateau, China

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Ostracod shells have widely been used as source material for geochemical analysis of stable isotope and trace element composition in paleolimnological reconstruction of lake hydrochemistry and climate as they provide insight into past water balance and solute evolution of lakes. During five fieldtrips to the Tibetan Plateau, taking place between 2008 and 2012, we collected live and sub-recent ostracods from 333 sites. Hydrochemical parameters, such as temperature, electrical conductivity, pH as well as major and minor ion concentrations were measured at each site and show high variability between sites. Adult intact individuals from the most common ostracod taxa *Leucocytherella sinensis*, *Leucocythere dorsotuberosa*, *Limnocythere inopinata* and *Tonnacypris gyirongensis* were selected and their shell chemistry analyzed. The trace elemental data for the living ostracods compared to the hydrological data provide a calibration dataset for further hydrological and thus climatological reconstruction. Mg/Ca, Sr/Ca and Ba/Ca ratios in ostracod shells provide information about past water temperature and salinity resulting from changes in precipitation vs. evaporation ratios and monsoon activity. Furthermore, Mn/Ca, Fe/Ca and U/Ca ratios are being explored as redox indicators to reconstruct oxygenation cycles.

To reconstruct the monsoon dynamics on the Tibetan Plateau, two long sediment cores from lakes Nam Co and Tangra Yumco, covering the past 20,000 years. The lakes feature an alkaline environment but show significant differences in their electrical conductivity, ranging from 1.8 mS/cm at Nam Co to 12 mS/cm at Tangra Yumco. The chemical composition of valves of the most common ostracod species in these lakes, *Leucocytherella sinensis*, was analyzed using laser ablation ICP-MS. The reconstruction provides a more extensive insight into past precipitation – evaporation balance and lake level change and provides clues about the interaction between the different air masses (Indian Ocean Summer Monsoon, East Asian Summer Monsoon and Westerlies) and thus monsoonal dynamics.

Early Devonian ostracods from the Kuan Tang Formation, Satun province, Southern Thailand

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Ostracods were recovered from the red stromatolitic limestone of the Kuan Tang Formation which cropped out in Satun area, in the South of Thailand. The ostracods are belonged to Paraparchitoidea, Bairdiocyprididae, Bairdioidea. Species of, for example, *Paraparchites, Samarella, Shemonaella, Bairdocypris, Bairdia, Bairdiacypris, Acratia*, *Longiscula* are identified. Macro- and micro-fossils have been reported from the studied section; for example, the age Early Devonian was defined by trilobite fauna and conodonts. The dacryoconarid tentaculitids are very abundant and also identified herein. The faunas can be correlated with those found in western Thailand and Malaysia. In this study, the palaeoenvironment of the section is interpreted by the ostracod assemblage. Thus, this study is the first report of the Middle Paleozoic ostracods from Thailand which provides the first information of the fauna from the Sibumasu Terrane.

Effects of altitudinal gradients in Neotropical ostracod species composition and distribution: an example from north-central Guatemala

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The northern Neotropical region is characterized by irregular orography with high elevation gradients due to their proximity to subduction zones. These orographic changes are well known to have important implications in species diversification, distribution and ecology (Anderson *et al*., 2011). North-central Guatemala offers the opportunity to study the effects of elevation gradients on the Neotropical freshwater ostracod fauna, because the region varies from 100 m a.s.l. in the northern lowlands to more than 3,200 m a.s.l. in central highlands. In this paper we evaluate how ostracode species composition and distribution are affected by altitudinal gradients and which mechanisms are used by the species to tolerate both tropical and temperate climates.

A total of 20 freshwater ecosystems (lakes, lagoons, rivers and ponds) were analyzed, 11 in the lowlands and 9 in the highlands. Fourteen physical and chemical variables were measured at each site, but based on forward selection after a preliminary multivariate analysis with all variables, seven parameters (dissolved oxygen, water temperature (Wt), pH, conductivity, salinity, altitude and lake depth) were selected because they were the most informative. Canonical correspondence analysis (CCA) was run with species and environmental variables. Rare species were down-weighted and Montecarlo test with 499 permutations was used to evaluate the results. Two-tailed Spearman correlation was used to calculate the relationship between variables and species.

Thirty ostracode species were identified in the study area: nineteen inhabit lowlands and eleven are characteristic of the highlands. Because of a poor existing taxonomy we described five new species and one new genus from the highlands: *Cypria altana* sp. nov., *Pseudostrandesia guatemalensis* sp. nov., *Tanycypris atitla* sp. nov., *Hemicypris amati* sp. nov., *Amaticypris cerina* gen. nov., sp. nov. *Darwinula stevensoni* was the only species present in both high and lowlands. The first axis of CCA diagram explained 46% of the relationship between species and variables ($P > 0.002$, F-ratio=1.16) with altitude, Wt and conductivity as variables mostly affecting species composition and distribution.

Species assemblages from the lowlands are distinctively different from highland assemblages. Lowland assemblages are characterized by *Cypria petenensis*, *Cytheridella ilosvayi*, *Diaphanocypris meridana*, *Vestalenula pagliolii*, *Cypridopsis inaudita*, *Strandesia intrepida*, *Cypretta* sp. and *Typhlocypris annae.* Highland assemblages include the newly described species as well as *Candona* sp., *Ilyocypris* sp. and *Chlamydotheca* sp. Our results suggest that the distribution limits for tropical species are located at 1000 m a.s.l, where the lowest water temperature is 26°C. In contrast, temperate species are restricted to altitudes higher than 1200 m a.s.l. with water temperatures below 24°C. In El Pino lake located at 1038 m a.s.l. it was observed the presence of tropical and temperate species and therefore this elevation is considered transition zone between faunas. The ability of *D. stevensoni* to be present in both tropical and temperate lakes may result from its high clonal diversity that allows different lineages to adapt to a broad range of environmental conditions (Van Doninck *et al*. 2002). Species diversity is higher in the lowlands and decreases with altitude. This is in contrast with findings for the Ordu region, Turkey, where higher diversity was observed at higher altitudes (Külköylüoğlu *et al.* 2012). The differences between the regions could be the result of the availability of a great variety of niches and ecosystems in the Neotropical lowlands that may favor species diversification. This study highlights the sensitivity of ostracode species to altitudinal and water temperatures changes and emphasizes their potential as bioindicators of climatic changes in palaeoenvironmental studies.

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Geographical parthenogenesis in northern Neotropical freshwater ostracodes? Understanding the causes using two widely distributed species

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Reproductive biology in ostracodes is one of the most important ecological characteristics of the group because it determines distribution patterns, environmental tolerances and genetic diversity of species. The understanding of species sexuality in a region is therefore a key for accurate interpretation of biogeography, evolution and paleoecology. In order to investigate how the sexuality and, in particular, how the geographical parthenogenesis is affecting the Neotropical ostracode fauna, we conduct a species distribution analysis, based on sampling campaigns carried out between 2010-2014, from central Mexico to Nicaragua, and records obtained from the available literature. *Chlamydotheca unispinosa* and *Cytheridella ilosvayi* were selected for this analysis, because they are widely distributed in the Neotropics. Abundant populations were collected in our sampling area and different types of reproduction (sexual and asexual) were observed. Molecular analyses based on the COI gene were conducted in 40 specimens from twenty populations of *C. ilosvayi* and 12 specimens from six populations of *C. unispinosa*, in order to investigate their genetic diversity.

Sixty-nine populations of *C. ilosvayi* (11 sexual, 48 asexual and 10 represented by empty valves or juveniles) and ten populations of *C. unispinosa* (3 sexual, 7 asexual and 2 represented by empty valves or juveniles) were found in our studied area. *Chlamydotheca unispinosa* is considered a geographical parthenogen, with sexual populations restricted to the cenotes (sinkholes) and caves in north-central Yucatan peninsula (México), while asexual populations are widely distributed in a variety of ecosystems in the Neotropics and also in the Nearctics (western United States). *Cytheridella ilosvayi* displays an incomplete geographical parthenogenesis with frequent and broadly distributed asexual populations, whereas sexual populations are scarce and scattered across the region. Molecular analyses reveal divergences (p-distances) up to 10% among *C. unispinosa* populations and up to 12% among *C. ilosvayi* populations, suggesting high cryptic diversity in both species. These genetic patterns agree with results from *Eucypris virens* (European geographical parthenogen) for which high genetic diversity was attributed to multiple origins of lineages (Horne & Martens 1999; Bode et al. 2010). The causes that may have triggered the geographical parthenogenesis in the Neotropics cannot be assigned to a single geological event such as the Last Glaciation in Europe (Horne & Martens 1999), but rather to a series of abrupt climatic changes that occurred during the Pleistocene and Holocene. Evidence from Lake Petén Itzá (Guatemala) suggests at least three important events that drastically affected ostracode species composition: 1) Cold environments during the Marine Isotope Stage 6 (MIS6) that caused a replacement of species from tropical to temperate; 2) a drastic drought period at around ~95ka that caused a drying out of most of the surficial lakes in the region (Hodell et al. 2008); 3) absence of tropical species that do not tolerate temperate conditions such as *C. ilosvayi*, during the LGM and the deglacial (Pérez et al. 2011). The continuous processes of species replacement and recolonization may have acted in favor of asexual lineages, which are characterized by superior colonizing abilities in comparison with their sexual relatives. The survival of sexual lineages of *C. unispinosa* can be attributed to their adaptation to sub-subterranean environments that act as a refugee during climatic changes, while *C. ilosvayi* sexual lineages seem to be continuously colonizing the region, however, in constant competition with their asexual relatives. Our results show that climatic changes have important effects for Neotropical ostracode species ecology, and the identification of these effects is highly valuable for the understanding of the evolutionary biology of the entire region.

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The implementation of taxonomic harmonisation for Candoninae (Ostracoda, Cypridoidea). A heuristic solution for *Fabaeformiscandona tricicatricosa* (Diebel & Pietrzeniuk).

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The concept of Taxonomic Harmonisation (TH) incorporates the search for similarities between taxa mentioned in different data sets and/or taxonomic classification systems, in order to propose a more coherent and homogenous taxonomic system necessary for practical use in basic and applied scientific activities. The implementation of TH is needed in order to realise a better understanding and usage of the taxonomy of Candoninae (Cypridoidea) ostracods. Within this species rich group there are a multitude of parallel taxonomic systems applied for Recent and/or fossil species groups. Horne *et al*. (2011) proposed a programme for the implementation of TH using Candoninae species as an example. Danielopol *et al*. (2011) emphasised this problem and noted that a priority is to improve the taxonomic diagnosis of Candoninae taxa starting with a better understanding of the basic disparity traits and continuing the search for stable morphologic traits usable for comparative diagnoses. This poster considers the use of *Fabaeformiscandona tricicatricosa* as a model for the practical implementation of TH.

The first requirement is an operational definition of what a *species* is within the context of the projected TH of the Candoninae. We consider that *F. tricicatricosa* is an *ecological species*, represented by a cluster of populations, with a given temporal persistence and with definite ecological preferences, namely for cold-water habitats. It has to be examined in close relationship with other *Fabaeformiscandona* species such as *F. caudata* (Kaufmann), *F. levanderi* (Hirschmann) and *F. siliquosa* (Brady). Another premise is the "harmonic" utilisation of multiple-methods of research with different degrees of descriptive precision. We show the advantages of a combination between traditional optical microscopy with SEM and with geometric morphometric data treated with multivariate statistics applied to the targeted taxa. As a third premise, we propose a protocol for the implementation of the TH of *F. tricicatricosa*. Finally, we offer a differential diagnosis for *F. tricicatricosa* and its morphological and/or potentially phylogenetic related species *F. caudata, F. levanderi* and *C. neglecta*.

An essential trait differentiating *Candona neglecta* from *Fabaeformiscandona* is the shape of the valve of the juvenile-stage A-3 which is more rectangular in *C. neglecta* compared with the pointed shape of the valves of *F. tricicatricosa* and *F. caudata*. There is a cluster of stable morphological traits which allows identification of *F. tricicatricosa* when compared to related *Fabaeformiscandona* species, namely the H/L ratio of the valve, the widely curved dorso-posterior outline and the straight section of the upper part of the posterior outline-section of the female right valve (fRV). The inner side of the posterior part the fRV displays specific shapes of a calcified ledge. Most of these traits are visible on published illustrations of *F. tricicatricosa* from various locations of the Holarctic, at sites in Europe, Siberia and the northern part of Canada.

The variability of *F. tricicatricosa* valves was studied using Recent and fossil specimens from several sites in Central Europe: in Austria (Mondsee), in Germany (Seeshaupt, Starnberger See, Zauschwitz), in Poland (lake Rospuda). We note slight shape differences due to environmental factors and/or to geographic distribution. The intra- and inter-site variability of valve shapes were evaluated using multivariate statistic algorithms on geometric morphometric data. With this experience at hand we attempt to solve taxonomic misidentications of *F. tricicatricosa*, namely the confusion with *F. caudata* and/or *Candona* of the *neglectoida* species-group. Procedures of TH indicate the unviability of two Candoninae taxa, namely *Eucandona* (Daday, 1900) and *Lozecandona* (Krstić, 2006), which are either based on an incorrect nominate species or on inconclusive diagnostic traits. Therefore, for the present TH-project we follow the taxonomic system of Meisch (2000), used also by Fuhrmann (2012).

In conclusion, Taxonomic Harmonisation (TH) is an onerous procedure. It requires time and energy for competent ostracodologists to develop better diagnosis for species that have potential applications for (palaeo)environmental reconstructions and/or to revise many taxonomically uncertain taxa. We are confident that this activity, if careful done, will be widely used.

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Devonian Ostracodes from Morocco (south-west Dra Valley) and the question of the Emsian/Eifelian boundary

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Variuos sections of Devonian strata in the Dra Valley, Anti-Atlas, Morocco, have been investigated by research groups from the University of Münster and the Senckenberg Institute, Frankfurt. Both groups found ostracodes within their samples as a by-product of their investigation for conodonts. From the Münster group (mainly R.T. Becker) 32 limestone samples collected for conodonts from the sections Bou Tserfine, Rich Tamelougou and Hassi Mouf South yielded silicified ostracodes of Early Emsian to basal Givetian age. From the Senckenberg group the sample FRA-TKZ 4c2 (coll. E. Schindler) was very rich in well preserved, silicified ostracodes. Moreover, the sample comes from near the Emsian/Eifelian boundary, a stratigraphical position which hitherto has not be drawn exactly in the Dra Valley either using conodonts or goniatites. In the literature the boundary is assumed to be within or at the top of the Rich 4 Sandstone Member, but due to the lack of macrofossils it cannot be pinpointed accurately. A newly found occurrence of large beyrichiids (*Zygobeyrichia subcylindrica*) within the overlying crinoid marls currently questions the position of the Emsian/Eifelian boundary within the Rich 4 Sandstone.

The Crinoid Marl Member at the base of the Yeraifa-Formation is assumed to be Eifelian in age by the Münster group, based on finds of indicator brachiopods (oral comm., R.T. Becker, 2012). G. Becker *et al.* (2004) also regarded the marls as Eifelian in age based on conodonts (*costatus* conodont Biozone), but recent reconsideration (K. Weddige; SIF) of the conodonts from sample Tork Giv1 determined a latest Emsian age (*patulus* conodont Biozone). The overlying basal beds of the goniatite bearing *Pinacites* Limestone undoubtedly belong to the Eifelian *costatus* conodont Biozone.

Three different but age-equivalent samples from the Crinoid Marl Member (about 1 m above the beyrichiid-bearing bed), comprising a total of more than 35 ostracode taxa, have been analysed biostratigraphically: samples FRA-TKZ 4c2 (coll. E. Schindler), Tor Eif-2d (collection Münster, section Hassi Mouf South) and Tork Giv1 (described in G. Becker *et al.*, 2004), of which additional residues was recently studied for conodonts and ostracodes.

Sample FRA-TKZ 4c2 yielded only one *Icriodus corniger rectirostratus*, which does not yield an exact date but which can draw comparison with the Heisdorf and Lauch Formations of the stratotype section in the Eifel area, Germany. The highly diverse ostracode fauna of 32 taxa shows similarities particularly with late Early Devonian (late Emsian) European faunas especially from Thuringia and have only rare middle Devonian indicators (e.g. *Polyzygia symmetrica*). Sample Tork Giv1 with rare conodonts of the *patulus* Biozone has a very similar composition of ostracodes. The same can be said for sample Tor-Eif-2d, but which is not nearly as rich in ostracodes as FRA-TKZ 4c2 and which hitherto has yielded no conodonts.

In summary, the ostracode faunas favour a position of the Early/Middle Devonian boundary to within the Yeraifia Formation, and not in or above the Rich 4 sandstone, in the spoth-west Dra Valley.

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Morphological and behavioural observations from culture experiments with *Cyprideis torosa*

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Cyprideis torosa is a euryhaline species and able to survive a very broad range of salinity. Among nodes on their valves, the shape of the sieve-pores may be used for salinity reconstruction. Although the relation between sieve-pore shape and salinity is well known, the mechanism behind remains unclear. To better understand this phenomenon, two series of microcosms with *Cyprideis torosa* were set up. The first experiment finished after 550 days, the second one is still running. The aim of this study is to analyze sieve-pore shape development and other morphological changes along the salinity gradient and under various water chemistry conditions. Whereas the first experiment focused on stable salinities along a gradient over the microcosms, the second explores effects of salinity variability. Starting from the original salinity values, salinity changes are provoked by evaporation and dilution. Besides morphological changes, behaviour, especially brooding and molting processes during salinity changes, is also monitored. *Cyprideis torosa* for the microcosms were collected from the southern Baltic See coast in Rostock (Germany) at a salinity of 13 for the first experiment and from Mediterranean lagoons near Enez (Turkey) at salinities of 18, 36 and 58 for the second one.

The first experiment revealed a significant negative correlation between salinity and noding as well as salinity and the proportion of round sieve pores. There is a tendency towards largest valves around a salinity of 9. This maximum is also reflected by the number of offspring along the salinity gradient. We explain this phenomenon by an internal osmotic value corresponding to this salinity. Interestingly, the slope of linear correlation lines between salinity and the proportion of round sieve pores shows a change at a salinity of 8, close to 9 as documented for the valve size maximum. A relation between salinity and valve shape is not recognizable. Also, changes of the ratio between males and females are not correlated to salinity.

Initial observations of the second experiment document a strong reaction of the animals when increasing the salinity from 58 to 85. They close their valves and become inactive. This behaviour can be finished quickly by decreasing the salinity. This observation demonstrates that salinity adaptation to very high values, as documented for instance from the Aral Sea, does not take place within one generation but probably stepwise over several generations. The results demonstrate the high potential of *Cyprideis torosa* as a water chemistry indicator.

Ostracoda as palaeoenvironmental proxies in the Holocene of Stralsund, southern Baltic Sea

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The old Hanseatic city of Stralsund is situated at the Strelasund, a narrow strait separating the Isle of Rügen from the mainland at the southern Baltic Sea coast. Several archaeological and geoscientific investigations have taken place within and around its old town during the last ten years. They document Holocene coastal evolution and anthropogenic impact in this area. Microfossils are a valuable tool for coastal geology and geoarchaeology. They allow the reconstruction of habitats and environmental parameters. This talk presents micropalaeontological data from six sections deriving from three sites, the archaeological excavations Mischwasserspeicher and Ozeaneum at the present day coast of the Strelasund and a 9.7 m long core from the pond Großer Frankenteich south of the old town. The sections cover the complete postglacial evolution including anthropogenic impacts. Several methods of analysis are demonstrated: indicator species approach, mutual ecological tolerances, ecological groups approach, intraspecific morphological variability and transfer functions.

Site evolution starts with the appearance of cold-stenotherm ostracods (*Cytherissa lacustris*, *Limnocytherina sanctipatricii*, *Fabaeformiscandona levanderi*) being successively replaced by typical interglacial taxa such as *Metacypris cordata*. They indicate a shallow lake under cool but warming climate. Estimations based on the MOTR method (Mutual Ostracod Temperature Range) give mean temperatures of -5 to 1°C in January and of 16 to 19°C in July, reflecting a slightly colder winter than today but summers similar to those of today. The Littorina transgression reached all three study sites about 7000 years ago. From then, calcareous microfossils occur only sporadically due to dissolution. The brackish water species *Cyprideis torosa* is the dominating ostracod here, coexisting with other brackish water species, e.g. *Loxoconcha elliptica*, *Xestoleberis aurantia*, *Cytherura gibba* and *Cypria subsalsa*. Mutual ecological tolerances as well as morphological analyses on *Cyprideis torosa* allow salinity estimations of 7 to 15 for the sites at the coast and of 4 to 7 for the confined basin of the Großer Frankenteich. The foundation period of the city in the early 13th century is reflected by high numbers of brick fragments within the sediment samples. Salinity estimations based on the still dominating brackish water fauna present salinities of 7 to 8, the same as nowadays. The core from the pond, however, shows the final stage of silting up with only a few small water bodies left. Ostracod associations and botanical macro-remains from the old harbour (site Ozeaneum) and in front of the north-western bastion (site Mischwasserspeicher) reflect a decline of submersed macrophytes over the 17th to 19th century probably caused by trampling, sewage and waste dumping. Interestingly, organic rich waste lenses within the harbour sediments contain quite high ostracod numbers, mostly *Cyprideis torosa* and *Loxoconcha elliptica*. Salt-tolerant freshwater taxa such as *Pseudocandona* spp. and *Cypria ophtalmica* become more abundant indicating increased freshwater input by water management around the city. The sediment succession is covered by debris of the 1870s when both seaward sites were subject to reclamation of land.

Checklist of the living non-marine Ostracoda (Crustacea) of Algeria

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If compared to permanent lakes and rivers, continental aquatic temporary habitats are strongly neglected when researches on biodiversity and ecosystem dynamics are concerned. This is especially true regarding ostracods in Algeria where a complete list of species is not available. Thus, the list of non-marine ostracods of Algeria presented in this study includes both the species reported in literature and those collected from 35 waterbodies in humid, semi-arid and arid regions of eastern Algeria during the wet period between the years 2005 and 2014. Sampling sites are located from -20 m to 1000 m of altitude and include a variety of aquatic environments, such as temporary pools marshes, saline lakes, sabkhas and chotts. Twenty eight taxa have been identified in this study, eight of which (*Cypris pubera*, *Ilyocypris decipiens*, *Eucypris lilljeborgi*, *Isocypris beauchampi*, *Limnocythere inopinata*, *Potamocypris smaragdina*, *P. villosa*, and *Prionocypris zenkeri*) are new to Algeria. Adding them, the number of living non-marine ostracods in Algeria arises to 41 species. A maximum of six species was found in a single sample. The most frequently collected species were *Eucypris virens* and *Cypris bispinosa*. Considering the size, location and diversity of microhabitats, the number of ostracods of Algeria is believed to be still underestimated. Further studies are required.

Rose Bengal and Ostracods: the case of the Lake Trasimeno (Umbria, central Italy)

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During July 2014 a sampling campaign was performed at the Trasimeno Lake (Umbria, central Italy; 43°09' N and 12°06' E) in order to study the living ostracod assemblages. Samples of the uppermost 4 cm of bottom sediments were collected using a rectangular hand-net (28 cm x 14 cm, 120 mm mesh size), preserved in the field in 75% ethanol and stained with Rose Bengal (following the standard procedure) for 36-50 h, to differentiate living (or recently died) from sub-fossil ostracods.

The Rose Bengal staining, widely adopted for foraminifer studies, is not commonly used by ostracodologists and is a matter of debate. The method is considered alternatively: 1) very unreliable, due to the possible organic pollution, to micro-organisms aggregated in the empty shells or to the presence of chitin, a molecule supposed not to be stained by Rose Bengal; 2) not completely satisfactory, as strongly stained specimens with soft parts have been found together with slightly stained empty valves; 3) appropriate to distinguish between ostracods of biocoenosis and thanatocoenosis.

After our experience, we can state that, at least in a freshwater environment like the Trasimeno Lake, the Rose Bengal staining is really puzzling. We observed adult and juvenile carapaces with appendages and soft parts, collected in the same sample, both strongly stained, lightly stained and completely unstained. This occurred in different species such as *Cyprideis torosa*, *Herpetocypris heleneae*, *Cypridopsis vidua*, *Ilyocypris salebrosa* and *Limnocythere inopinata*. Additionally, also loose valves bearing setae (fragile organs, easily destroyed) were differently stained.

We can conclude that, notwithstanding the scarce literature, Rose Bengal can stain chitin or chitosan (a derivative of the chitin biopolymer), as shown by the strongly stained carapaces with appendages. However, in ostracods the staining is not univocal and, thus, the Rose Bengal staining does not seem a reliable method to discriminate alone the living and sub-fossil specimens.

Late Miocene Mediterranean-Paratethys connection: new evidence from the ostracod fauna of the Strymon Basin (northern Greece)

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The Strymon Basin is an intermontane basin developed in the Hellenic hinterland as a consequence of a post-orogenic extensional tectonics related to the retreat of the Hellenic subduction zone and the widespread of the back-arc Aegean extension (Tranos and Lacombe, 2014).

The tectono-sedimentary evolution of the Strymon Basin is characterized by different stages of Mediterranean and/or Paratethian transgressions, which are recorded in the basin infill. In the northern part of the basin (Serres area), the base of the Neogene succession consists of coarse- to fine-grained continental deposits (Lefkon Formation) containing MN11 (upper Vallesian) mammal remains (De Brujin, 1989).

Above, coastal marine deposits made of sandstones, siltstones, and marly limestones (Dafni Formation), include late Tortonian-Messinian bivalves (*Anadara*, *Chama*, *Pecten*, *Anomia*, *Ostrea*, *Timoclea*), gastropods, and ostracods (*Grinioneis haidingeri*, *Callistocythere quadrangula*, *Sagmatocythere cristatissima*, *Sagmatocythere* sp., *Cytheridea neapolitana*, *Carinocythereis whitei*, *Aurila convexa quadricostulata*, *Aurila* sp., *Xestoleberis dispar*, *Xestoleberis* sp., *Loxoconcha pauciornata*, *Loxoconcha trilophosensis*, *Paracytheridea* sp., and *Cyprideis* spp.) from the Mediterranean bioprovince. Such assemblage points to a late Miocene Mediterranean marine transgression into the Strymon Basin.

Coarse- to fine-grained deposits (Choumnikon Formation) containing brackish-water molluscs (*Dreissena* and Limnocardiidae including *Paradacna abichi*) and ostracods (*Pontoniella acuminata*, *Camptocypria acronasuta*, *Caspiocypris pontica*, *Loxoconcha kochi*, *Loxoconcha eichwaldi*, *Loxoconcha muelleri*, *Loxoconcha rhombovalis*, *Loxocorniculina djafarovi*, *Loxocorniculina aegaea*, *Mediocytherideis apatoica*, *Amnicythere bisaltiana*, *Amnicythere crebra*, *Amnicythere multituberculata*, *Amnicythere pontica*, *Amnicythere* ?*cellula*, *Euxinocythere* (*Maeotocythere*) *praebaquana*, *Euxinocythere* (*Maeotocythere*) sp., *Tyrrhenocythere* sp. and *Cyprideis* sp.) from the Paratethian bioprovince unconformably overlie the marine deposits of the Dafni Formation.

Using high-precision chemical abrasion-thermal ionization mass spectrometry, U-Pb geochronology on single zircon grains from volcaniclastic layers found at the base of the brackish-water Choumnikon Formation, we obtained a date of 6.0976 ± 0.0055 Ma. This age points to consider the Dafni/Choumnikon boundary close to the Meotian/Pontian transition of the Paratethys, which corresponds to a regional transgression (Stoica et al., 2013).

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Holocene ostracod assemblages and evolution of the shallow freshwater Lake Vrana near Biograd (Croatia)

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Lake Vrana in Dalmatia is the largest natural lake in Croatia. It is a shallow, freshwater lake with a mean depth of 1.5 to 2 m, and a maximum depth of 4 m. It is divided from the sea by a narrow karst ridge (800 to 2500 m wide), and it is connected with the sea through the 800 m long artificial channel Prosika. The 11 m long core taken from the central part of the lake covers the last 12000 cal yr BP.

The information obtained from all the analysed data (ostracods, pollen, sedimentology and geochemistry) reflects three major periods of changes in the environmental evolution of the lake. According to the composition of the assemblages, five ostracod zones can be envisaged.

The first period (before 9150 cal yr BP; 1101-813 cm) represents a time interval in which the permanent lake was not yet settled and the palaeoenvironment can be described as a flooded karst polje with clastic facies rich in carbonate, followed by an organic rich, low energy wetland. This period includes three ostracod zones: the first one was dominated by *Candona neglecta* accompanied by *Hungarocypris madaraszi*, *Ilyocypris bradyi*, and few *Mixtacandona* sp., *Darwinula stevensoni* and *Cyprideis torosa;* the second ostracod zone documents the last occurrence of *Candona neglecta* and the first common recovery of *Cyprideis torosa, Candona angulata Heterocypris salina* and *Pseudocandona marchica*; in the third zone, ostracods are rare, and consists typically of freshwater dwellers inhabiting flood plains and ponds fed by springs. *Ilyocypris bradyi*, *Mixtacandona* sp., and *Hungarocypris madaraszi* are again present, together with *Paralimnocythere* sp., *Limnocythere inopinata*, *Candona* sp. and *Pseudocandona* sp. that occur in this zone for the first time.

The second period (9150-6100 cal yr BP; 813 to 485 cm) represents the early settlement of a permanent lake. In the sediment core it corresponds to the deposition of carbonate-rich silts, without detectable marine influence. In the second period, the fourth ostracod zone is distinguishable, consisting of freshwater species: *Herpetocypris reptans*, *Darwinula stevensoni*, *Candona angulata*, *Heterocypris salina*, *Pseudocandona marchica*, *Ilyocypris bradyi*, *Metacypris cordata* and *Cypria ophtalmica.* The composition of the ostracod assemblages along this zone depends up on the variations of temperature and lake water levels. Due to the recovery of *Metacypris cordata* this zone is further divided into four sub-zones.

The third period (6100 cal yr BP to Present; 485 to 0 cm) still mirrors a permanent lake but the carbonate sediments show a gradual increase of marine influence. Typical species for the fifth ostracod zone is *Cyprideis torosa*. This zone also contains many freshwater species which tolerate salinity increase. The present lake water conditions (alternating seasonal changes in the salinity, from freshwater to brackish) were established at 3800 cal yr BP (from 265 cm). According to pollen analysis (mixed conifer-deciduous forests dominated by *Pinus*, and open areas with herbaceous xerophytic communities and grasses), the oldest sediments (885-1100 cm) could belong to Preboreal and Boreal period. The middle part belongs to Atlantic period while vegetation was dominated by Mediterranean oak. Younger sediments could reveal population from Roman period until present times.

Shallow marine ecological degradation in Hong-Kong: a palaeoecological approach using ostracods

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Hong Kong is one of the largest and most rapidly developing cities in Asia. It is known that the marine ecosystems of Hong Kong have been seriously influenced by a variety of anthropogenic factors, including eutrophication, bottom trawling, coastal reclamation, pollution, etc. However, little is known about long-term history of human-induced marine ecological degradation in Hong Kong. Here we use microfossil ostracods as a model system and reconstruct marine ecological degradation history in Hong Kong, using grab samples from 55 sites covering almost entire Hong Kong's shallow marine areas and a long (42m) sediment core covering almost entire Holocene from offshore Lantau Island. The grab samples were subsampled from surface (0–1cm) and subsurface (1–20cm), representing present and past assemblages, respectively. Based on the ostracode census data obtained from these grab and core samples, Bray-Curtis similarity, cluster analysis, nonmetric multidimensional scaling (MDS), and regression models were used to investigate biogeographic distribution and temporal changes in Hong Kong marine ostracode fauna and diversity and their controlling factors.

Preliminary results of grab samples show that the common species are *Sinocytheridea impressa*, and *Neomonoceratina*. Species diversity was not significantly different between present (i.e., surface) and past (subsurface) assemblages. Pairwise comparison of Bray-Curtis similarity between present and past assemblages indicated lower similarity in Tolo Harbour and Victory Harbour sites, i.e., city sites, compared with other sites. Although this lower similarity in city sites may indicate recent ecological degradation in urban areas, further investigation is needed to understand the underlying mechanism. On the basis of MDS analysis, ostracod assemblages are similar within Western, Central and Eastern waters while no cluster is clearly identified in Southern waters.

The long sediment core indicates changes of ostracode assemblage for the past ~9000 years. Both absolute abundance (number of specimens/10g dry sediment) and species diversity increased since ~8000 cal yr BP. Three biofacies were identified in the core, using Q-mode cluster analysis based on Bray-Curtis index. Although these ostracode changes are likely related to Holocene sea-level changes, further investigation and analysis is needed. Full results will be shown at the presentation.

Taxonomic harmonisation of merged regional datasets of non-marine ostracods: a heuristic approach and its implications for palaeoenvironmental reconstruction

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The use of large distributional databases as training sets for proxy-based palaeoenvironmental and palaeoclimatic reconstruction is increasing, but local and regional databases rarely capture the full geographical or climatic ranges of species, necessitating the combination of data from more than one database – ultimately on a global scale. Taxonomic harmonisation when two or more databases are merged is aimed at ensuring, as far as possible, that the taxonomic names used are consistent and correct. For example, to improve calibrations of chironomid larvae used in transfer functions for palaeotemperature reconstruction, different regional datasets have been amalgamated and harmonised taxonomically through discussion and agreement between specialists, resulting in some loss of taxonomic resolution. As applied to the merging of ostracod data from European and North American datasets that is currently in progress for the OMEGA project (Ostracod Metadatabase of Environmental and Geographical Attributes), the process involves consideration of generic assignments as well as the recognition of synonyms and misapplied names (misidentifications). Neontological and palaeontological taxonomic schemes also need to be harmonised in order to realise the potential of the fossil record for understanding phylogeny and the origins of biodiversity. Full taxonomic harmonisation may take many years, even generations, to approach completion, and in global terms we are still on the exponential phase of the growth curve towards that goal, although we may be close to where it begins to flatten out with regard to the living European fauna. To facilitate advances in palaeoenvironmental and palaeoclimatic reconstruction in spite of the plurality of species concepts and the uncertainty inherent in taxonomic harmonisation, we advocate the adoption of a heuristic taxonomic principle. Such an approach allows scientists to proceed with studies (e.g. ecology, biogeography, palaeoenvironmental analysis, palaeoclimate reconstruction, biostratigraphy) even though the taxonomic frameworks they use may be incomplete, inconsistent or incompatible with those used by others (including cryptic species that can only be detected by molecular techniques and applying the genetic species concept). In broader biological and palaeontological contexts the heuristic concept has been around for a long time and continues to be advocated in recent literature, for example in relation to parasitology, microbiology and, of course, Quaternary palynological studies, in which genus-level resolution is typically the best that can be achieved. We discuss the adoption of a heuristic taxonomic approach in the context of Quaternary and living non-marine ostracods from the Northern Hemisphere, focusing on case-histories of limnocytherid and candonine taxa. We consider the Holarctic *Limnocythere inopinata*, which in North America has commonly been regarded as two species: *L. inopinata* (parthenogenetic) and *L. sappaensis* (sexual), a distinction biogeographically supported by evidence that their distributions are influenced by particular solute chemistries. We also evaluate the utility of certain genera or subgenera in the Limnocytheridae (*Limnocythere* and *Limnocytherina*) and Candoninae (*Candona*, *Fabaeformiscandona* and *Eucandona*) and consider the implications of cryptic species (e.g. in the cypridid *Eucypris virens*).

Homeomorphy in subterranean Candoninae: Geometric morphometrics of the valve shape and molecular phylogenetic approaches applied for a new species from a chemoautotrophically based Movile Cave ecosystem

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Subterranean species have historically attracted the attention of the evolutionary biologists due to their homeomorphic characters and convergent evolution. The homeomorphy in ostracods is a common phenomenon especially when we deal with the carapace shape. However the understanding of the mechanisms and causalities for convergences still remains elusive.

To study if the triangular valve shape, commonly observed in subterranean ostracods, derived from a common ancestor or it is the result of homeomorphy we took the advantage of a finding of a new subterranean species with triangular valves, belonging to the subfamily Candoninae. This new species, resembling representatives of the genus *Typhlocypris*, lives in the Movile Cave in Dobrogea region of SE Romania. The cave ecosystem is chemoautotrophic with thermal waters rich in sulfide, ammonium and methane, but with low contents of oxygen. To assign our new Movile species to the appropriate genus and to determine its phylogenetic relationship within the subfamily, in addition to the routine taxonomical description of limbs and valves, we used: a) the geometric morphometrics for the valve shape analysis followed by the multivariate analyses using classification and ordination techniques; and b) the DNA sequences of the mitochondrial *COI* gene of the Movile species compared with two triangular subterranean species of the genus *Typhlocypris* (*T. eremita s.l.* and *T. sywulai*), two non-triangular surface water ones of *Pseudocandona* ex gr. *compressa* (*P. albicans* and *P. compressa*) and two also non-triangular surface water species of the *Pseudocandona* ex gr. *rostrata* (*P. hartwigi* and *P. marchica*) as well as two species of the genus *Candona* (*C. candida* and *C. weltneri*) as outgroups.

The results of the phylogenetic tree constructed from the molecular data and those of the phenetic tree/scatter diagram based on geometric morphometry evidenced a rather contradicted picture. While geometric morphometrics techniques revealed close similarity of the Movile species with the subterranean triangular *Typhlocypris* species, the *COI* sequence of the Movile species appeared most similar with the non-traingular *Pseudocandona* ex gr. *rostrata* species. The gene tree provided more resolution of the evolutionary pathways and reflected more complete and reliable lineage relations among the analysed species. Based on both the mtDNA data as well as on the morphological limb and detailed valve traits we assigned the Movile species to the *rostrata*-group of the genus *Pseudocandona*. The triangular shape of the new species is interpreted as a homeomorphy and convergent evolution characteristic for several subterranean species of Candoninae via colonisation of the subterranean realm. We assumed that both molecular systematics and geometric morphometry approaches are essential to detect the evolutionary trends in Candoninae.

Sublittoral ostracod fauna of the Upper Miocene - Szák Formation, Hungary

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Lake Pannon was a large, long-lived, brackish lake that occupied the Pannonian Basin System in the Late Miocene and earliest Pliocene. Life and depositional environments in the sublittoral zone of Lake Pannon were reconstructed for the period 9.4-8.9 Ma from fossils (molluscs, ostracods, fish, dinoflagellates, calcareous nannoplankton, green algae and phytoplankton) and facies of the Szák Formation. The silty argillaceous marl of the formation was deposited below storm wave base, at 20-30 to 80-90 m water depth (Cziczer *et al*., 2008).

Ostracods have been investigated from the Tata outcrop: 50 taxa have been identified, dominated by endemic species and endemic genera of candonids, leptocytherids, cypridids, and loxoconchids. Twenty-two species were recognised: *Amnicythere cornutocostata* (Schweyer 1949), *A. larga* Krstić 1973, *Amplocypris* aff. *bacevicae* Krstić 1973, *A. sinuosa* Zalányi 1944, *Bakunella dorsoarcuata* (Zalányi 1929), *Camptocypria brusinai* Sokać 1972, *C. balcanica* Zalányi 1929, *C. lobata* Zalányi 1929, *Caspiocypris alta* (Zalányi 1929), *Cypria tocorjescui* Hanganu 1962, *Cyprideis macrostigma* Kollmann 1958, *Euxinocythere praebaquana* (Livental 1929), *E. naca* (Méhes 1908), *Herpetocyprella auriculata* (Reuss 1850), *Lineocypris reticulata* (Méhes 1907), *L. caudalis* Krstić 1972, *Loxocornicula djaffarovi* Schneider 1956, *Serbiella* aff. *truncata* Sokać 1972, *S.* ex. gr. *unguicula* (Reuss 1850), *Typhlocypris* cf. *T.* sp. 4 Krstić 1972, *Zalanyiella venusta* (Zalányi 1929) and *Loxocornicula djaffarovi* Schneider 1956.

Some species found their way to the Dacian Basin during the Pontian (*Cypria tocorjescui*, *Serbiella* aff. *truncate)*, or migrated into the Euxinian (Black Sea) and Caspian Basin (*Amnicythere cornutocostata*, *Bakunella dorsoarcuata*, *Camptocypria balcanica*). During the Messinian "lagomare" event, *Euxinocythere prebaquana*, *Loxoconcha* aff. *schweyeri* Suzin 1956, *Zalanyiella venusta*, and *Loxocorniculina djaffarovi* appeared in the Mediterranean (Gliozzi & Grossi 2004).

Many species have been left in open nomenclature, because they are known only from juveniles (*Lineocypris*) or incompletely preserved valves (*Zalanyiella*). One new species of the genus *Euxinocythere* is described.

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Ostracod and molluscan palaeoassemblages from the Holocene deposits of the Polish part of the Vistula Lagoon, the Baltic Sea

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Vistula Lagoon is today a reasonably large (90 × 10-19 km, 838 km^2) and shallow (up to 5.2 m deep) brackish water lagoon (salinity 0.1-4.9‰) at the southern coast of the Baltic Sea. It is separated from the Gulf of Gdańsk by the narrow sandy barrier of the Vistula Spit and only the Baltiysk Strait connects the lagoon with the Gulf. The lagoon is divided into the Polish (43.8% of the whole surface) and Russian parts and characterised by high degree of eutrophication and increasing anthropogenic impacts. Although, our knowledge on the Holocene evolution of the Vistula Lagoon is far from being complete, previous studies have documented that the formation of the basin of the lagoon and its further development as well as changes of salinity and water level had been associated mainly with a combination of the effects of both the marine transgressions and the intensity of riverine discharge during the successive geological stages of the Baltic Sea.

To trace environmental changes in water hydrology and salinity of the Vistula Lagoon after its deglaciation, the distribution of mollusc shells and ostracod valves was examined in 12 long (6-15 m) sediment cores collected from the Polish part of the lagoon. Due to low lithological variation of the sequences, in total 74 samples, each of 200 cm^3 volume, were selected as the most representative for the most important time windows of the Holocene. In addition, mollusc and ostracod remains from surface layers (the uppermost 2 cm) of the short sediment cores taken at 21 sites were included in the analysis.

The studied long sediment sequences yielded ca. 5400 shells of 27 mollusc species and 5200 valves of 23 ostracod species, while the surface sediment samples provided additional 5200 mollusc shells and 1550 ostracod valves. In the long core sequences the most common species were ostracods *Cyprideis torosa* (present in 10 cores), *Candona neglecta* (9 cores) and *Darwinula stevensoni* (7 cores), a gastropod *Valvata piscinalis* (12 cores) and bivalves *Pisidium* sp. (10 cores). Successive changes of the structure and species composition of the distinguished subfossil ostracod and mollusc assemblage types indicate cyclic inflows of marine waters into the Lagoon through the Vistula Spit. Freshwater assemblages of molluscs (*V. piscinalis*, *Bithynia tentaculata*, *Dreissena polymorpha*, *Sphaerium* spp.) and of ostracods (*C. neglecta*, *C. candida*, *D. stevensoni*, *Cytherissa lacustris*, *Limnocythere inopinata*) were replaced in stratigraphical order by the assemblages dominated by brackish-water or euryhaline species of marine gastropods *Hydrobia ulvae* and *H. ventrosa* and ostracods *C. torosa* and *Cytheromorpha fuscata* or even typical marine bivalves *Cerastoderma glaucum* and *Corbula gibba* were occasionally recorded.

Through the studied deposits the ostracod and molluscan evidence are in accord and provide hydrological and environmental information on the postglacial evolution of the Vistula Lagoon. It is clear that the deposits studied here formed under changing environmental conditions (mainly salinity and depth), however their intensity and timing differed in various parts of the lagoon. The highest molluscan and ostracod diversity was documented in the south-western, the most freshwater part. The present results confirm inferences based on previously published biotic (diatomological and palynological data) and abiotic (granulometry, geochemistry, mineralogy) indices from this area.

Estimating co-occurrence assemblages and environmental tolerance of non-marine Ostracoda

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The aim of this study was to determine the relationship between co-occurrence assemblages and tolerance levels of 103 non-marine ostracods reported from 1380 different aquatic sites of Turkey. The material includes samplings done from 20 different cities (regions) along with 15 different environmental variables. Among the species, *Heterocypris incongruens*, *Ilyocypris bradyi,* and *Psychrodromus olivaceus* showed the highest occurrences in 558, 465 and 282 different aquatic bodies, respectively. According to the probabilistic model (Veech 2013), 4914 of 5253 pairs of combinations were removed from the analyses because expected co-occurrence was <1. The rest (339 pairs) of the expected values showed 21 positive and 31 negatively significant co-occurrences while 287 co-occurrences were random (not significant). Although they were the most frequently occurring species, the expected co-occurrence was negative between *H. incongruens* and *P. olivaceus,* and positive for *H. incongruens* and *I. bradyi*. According to transfer function analysis, these species exhibited higher levels of tolerances to different environmental variables (e.g., water temperature, pH, salinity and dissolved oxygen) than the other species. Having such high tolerance levels support the wide ranges of geographical distribution of these species that can be called as “cosmoecious species”. Canonical Correspondence Analyses displayed that temperature was the most effective factor on the species. Thus, overall, the results suggest that species with high levels of tolerances can co-occur within the similar ranges when they may not be affected by big environmental fluctuations in the waters. This can give a chance for these species to survive in different types of habitats.

Environmental changes in Lake Qinghai, NE Qinghai-Tibet Plateau, over the past 32 ka, inferred from ostracod species and their stable isotopes

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In the past decades, the paleoenvironmental/paleoclimatic changes were widely studied using different proxies from lakes distributed in the Tibetan Plateau (TP). However, there are few well-dated, high-resolution records of lacustrine climatic/environmental change in the TP during the last glacial period.

With the support of the International Continental Drilling Program (ICDP), Lake Qinghai (located in the northeast TP) was drilled in 2005 using the ICDP GLAD800 drilling system. In this study, we present a 32 ka long ostracod isotope ($\delta^{18}O$ and $\delta^{13}C$) record based on one of the longest and highest quality drilling cores obtained from Lake Qinghai in 2005. Variations in ostracod species and their oxygen and carbon isotopes provide evidence of environmental change since 32 ka. During the last glacial period, the enriched $\delta^{18}O$ and $\delta^{13}C$ values coincide with low TOC and pollen contents under cold and arid climate conditions that were correlated previously with North Atlantic Heinrich events 3 and 2 from 32 ka to 24 ka. In contrast, interstadials and the entirety of the Last Glacial Maximum were marked by much more depleted $\delta^{18}O$ and $\delta^{13}C$ values of ostracod calcite, reflecting increasing lake levels caused by large amounts of snow/glacial meltwater related to increased temperature and summer insolation. Increased isotopic values and low TOC content showed that the lake level decreased sharply due to very dry and cold climate, plus the sharp decrease of meltwaters from 16 ka to 15 ka. This period roughly coincided with Heinrich Stadial 1 (H1). After 15 ka, coinciding with the start of the Bolling-Allerod period, $\delta^{18}O$ and $\delta^{13}C$ values decrease and TOC increases, indicating a transition to warmer and/or wetter conditions, resulting in increased lake level. The decrease and even disappearance of ostracod shells with enriched $\delta^{18}O$ shows that the lake level decrease due to cold and dry climate during the period 12 ka to 11.6 ka, which roughly coincided with the Younger Dryas (YD).

After 11.6 ka, the climatic and lake environment during the Holocene in Lake Qinghai may be summarized as follows: 1) low lake level, high water salinity under the warmest and wetter climate during the early Holocene, 2) increasing lake level, decreasing water salinity under the warm and wet climate during the middle Holocene, and 3) increasing lake level, increasing water salinity under the warm and dry climate in the late Holocene. In general, the coupled temperature and hydrological variations on multiple timescales collectively support the idea that summer temperature may have played an important role in affecting lake level changes by controlling evapotranspiration loss for Lake Qinghai. This result suggested that hydrological response to monsoon/climatic variation could be more complex than that in monsoon-influenced humid regions, since evapotranspiration loss (caused by temperature) and precipitation are both very important factors in the arid/semi-arid monsoon boundary region.

Genetic diversity on *Cypretta campechensis* and *Diaphanocypris meridana* group in northern Neotropics, new species or cryptic diversity?

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The Northern Neotropics is considered one of the regions with highest diversity for most of the aquatic taxa. In copepods and cladocerans this diversity is composed of a high number of endemic and cryptic species resulting from a long geological and climate history (Suárez-Morales *et al*., 2005; Elías-Gutiérrez *et al*., 2008; Cohuo-Duran *et al*., 2013). The identification of endemic areas and cryptic species is non-random with regard to taxon and biome and, therefore, these species have significant implications for evolutionary, biogeography and conservation studies (Bickford *et al.*, 2007). In order to investigate whether the high intra- and inter-population morphological variability and the broad environmental tolerances observed in widely distributed *Cypretta campechensis* and *Diaphanocypris meridana* is a result of cryptic diversity or endemicity, we conducted combined analyses of morphology, genetic diversity and distribution patterns of these species. Ten populations of *C. campechensis* and *D. meridana* were sampled from southern Mexico to Nicaragua. Results based on DNA sequences of the cytochrome oxidase subunit I (COI) gene on *C. campechensis* discriminate six mitochondrial linages with genetic distances as high as 24% (uncorrected *p*-distances). Each group corresponds to a different geographically areas: southern Quintana Roo and southern Campeche (Mexican states), northern and southern Guatemala, southern El Salvador and northern Honduras. For *D. meridana*, seven groups of divergent candidate species were discriminated using the COI gene, with divergences up to 29% (uncorrected *p*-distance). A pattern within the distribution areas was missing; in some lakes, two different coexisting lineages at genetic level were identified. The molecular information was particularly informative in this work, because in *Cypretta champechensis* populations the combination of p-distances values and differences in sexual appendages allows to discriminate the populations as five additional species and therefore highly endemic to their distribution areas. The high genetic differences observed in *D. meridana* populations, however cannot be considered enough evidence of speciation, because only specimen size differ among populations. The seven lineages observed in this work, therefore should be considered as a cryptic species. The molecular variability in his group can be related to the asexuality of the species and this could explain the great environmental tolerance observed in the region. Similar patterns have been observed among the populationsof *Darwinulids* and *Eucypris virens* from Europe as a result of multiple origins of asexual lineages (Schön *et al.* 2012; Bode *et al.* 2010).

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First evidences of Neotropical glacial/interglacial (220-121 ka BP) climate change based on freshwater ostracodes and geochemical indicators from Lake Petén Itzá sediments, Guatemala

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The northern Neotropics is a key region for understanding past climatic changes and their role in shaping the actual environment. Preliminary tephrochronology provided by ash layers from cores PI-1 and PI-7 retrieved from 65m and 46m water depths, respectively, in Lake Petén Itzá suggests that the stratigraphic sequence extends back to 220 - 230 ka for core PI-1, and at least to 280 - 260 ka for core PI-7. The paleoenvironmental history during the last 85 ka in the northern Neotropics has demonstrated high climatic variability based on multiproxy evidence (Mueller *et al*., 2010, Escobar *et al.*, 2012, Pérez *et al.* 2013). However, previous work provided very little information from aquatic organisms such as ostracodes, which react to climate and environmental changes faster than terrestrial proxies (Ilyashuk, 2009). Therefore, this work provides the first evidences of environmental change based on fossil ostracode assemblages and geochemical indicators from the age window of 220 - 121 ka. Results from ostracode species composition and geochemical analysis during Marine Isotope Stages (MIS) 5, 6, 7 can be summarized as follows: 1-- MIS 7 was characterized by drastic fluctuations of total inorganic carbon (TIC) and total organic carbon (TOC) that we preliminarily assign to the climatic variations 7.1 to 7.4, observed in Antarctica ice cores (Jouzel et al., 2007). The ostracode assemblage consists of *Cytheridella ilosvayi* and *Cypria petenensis*, two tropical species that inhabit warm waters (>20 °C) during phases characterized by lower lake level (<40 m). 2-- During the glacial MIS 6, decreasing C/N ratios attest to a decrease in terrestrial input and thus a more humid climate and higher lake level. Ostracode diversity was low, with the exclusive presence of *C. petenensis* at the beginning of MIS 6, indicating deep (50-60 m) and moderately warm waters. At the end of this period, the ostracode assemblage experienced a species replacement; tropical species were replaced by temperate species such as *Darwinula stevensoni*, *Typhlocypris* sp.2 and *Cyprididae* sp. indicating a change towards a colder climate and low lake level. 3-- MIS 5 shows great variability in TOC (<2 %), TIC (10%) and C/N ratios (5 - 20) at the beginning of the period suggesting a rapid climate change from cold to warm and from dry to humid. At around 121 ka ostracode abundance reached a maximum of up to 1000 valves per gram with presence of the nektobenthic species *C. petenensis* and the benthic species *C. ilosvayi*, indicating a dominance of littoral ostracodes and thus low lake levels; this period probably coincides with the Eemian.

This study provides first climate information based on ostracode species composition and geochemical proxies showing that during the interglacial periods MIS 5 and MIS 7 climate was warm and lake level was low. During glacial MIS 6 the ostracode species replacement evidence underlines abrupt climatic change from warm to cold conditions.

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Ostracods from Middle Pleistocene lake sediments at Marks Tey, Essex, UK: Qualitative and quantitative approaches to palaeoenvironmental reconstruction

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The lacustrine sedimentary succession at Marks Tey in Essex, UK, comprises the most complete record of the Hoxnian interglacial (MIS 11c) in Britain (Ashton *et al*., 2008). Although the sequence contains some hiatuses, it potentially records the entire interglacial and the transition to the following glacial stage. Not only is the succession largely complete, but it offers high-resolution: much of the >30m thickness of sediment is laminated and in some intervals, laminations are considered annual (Turner, 1970; Candy *et al*., 2014; Horne *et al*., 2014). It is therefore an ideal site at which to investigate abrupt climate changes. Current research is focused on exploring how the palaeoclimate and palaeoenvironment changed throughout the interglacial to glacial transition, using a multiple-proxy approach to studying ostracods.

This paper will present preliminary results that demonstrate changes in dominant species throughout the succession, together with taphonomic analysis and palaeoenvironmental and palaeoclimatic reconstruction. Approximately 30 species are represented, including *Cytherissa lacustris* (Sars, 1863), *Limnocythere suessenbornensis* (Diebel, 1968), *Limnocythere inopinata* (Baird, 1843) and rare *Limnocythere parallela* (Diebel, 1968) (believed to be the first record from the UK). In addition, the analysis of stable isotopes within the calcite shells and the possibility of applying a quantitative analysis following Holmes *et al*. (2010) will be discussed.

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Living ostracod assemblages of Lake Trasimeno (Umbria, central Italy)

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Multiproxy environmental investigations of Lake Trasimeno (Umbria, Italy; 43°09’ N and 12°06’ E) include for the first time the study of living ostracod assemblages in order to further improve the knowledge about the Italian living ostracod fauna. Moreover, ostracod occurrence, macrophyte vegetation and environmental parameters will form a well-structured data base for future palaeoenvironmental investigations. Today, the meso-eutrophic Trasimeno Lake has a maximum depth of about 6 meters and extends over a surface of 120 sq km, encompassing a large variety of ecological niches. It is fed by groundwaters as well as meteoric waters and runoff, and its water level is highly variable.

Thirty-eight samples of the uppermost 4 cm of bottom sediments and one water surface sample among free floating macrophytes (*Spirodela polyrrhiza*, *Lemna minor*, *Lemna trisulca*) were collected for ostracod analyses. Several environmental variables were measured at each site during sampling: water temperature (T, °C), dissolved oxygen content (DO, mg/L), conductivity (C, µS/cm) and pH. The chemical analyses of macro-elements of two bottom water samples point to Cl, SO_4 - Ca, Mg water according to the Piper classification. The sediment grain size as well as the presence and type of aquatic macrophytes were recorded. The samples yielded 20 living species of ostracods referable to 14 genera: *Darwinula stevensoni, Candona (Candona) candida, Candona (Neglecandona) angulata, Fabaeformiscandona fabaeformis, Fabaeformiscandona harmsworthi, Pseudocandona marchica, Cypria ophtalmica, Ilyocypris gibba, Ilyocypris salebrosa, Ilyocypris getica, Cypridopsis vidua, Eucypris virens, Trajancypris clavata, Herpetocypris helenae, Heterocypris salina, Heterocypris incongruens, Isocypris beauchampi*, *Cyprideis torosa, Limnocythere inopinata,* and *Limnocythere stationis. Candona angulata*, *C. vidua*, *C. torosa* and *L. inopinata* are the most abundant species. A few valves of *Potamocypris zschokkei* have also been collected but without soft parts thus this species is not considered as living in the lake. It is worth to note some novelties in the frame of the living ostracod fauna of Italy: *F. hamsworthi* is signalled here for the first time; *L. stationis* was previously found only from Cà Nuova rice-field (northern Italy); the recovery of *C. torosa* represents the first Italian report from an athalassic lake. Multivariate statistical analyses (non-Metric Dimensional Scaling, Canonical Correspondence Analysis and Spearman rank order correlation) have been applied to the entire dataset to characterize the ecology of the different ostracod assemblages. The occurrence of *C. angulata* and *C. torosa* seems to be strictly linked to depth, DO and pH parameters, since this assemblage was mainly recovered in the central part of the lake, from 320 to 520 cm of depth, with very fine substrate sediment, without vegetation and slightly alkaline pH values (7,7-8,7); *L. inopinata* and *I. salebrosa* prefer shallow waters, the warmest temperatures (above 25°C) and the presence of vegetated bottoms; *C. vidua*, *D. stevensoni*, *H. helenae* and *I. gibba* are always associated with macrophytes. In particular, *C. vidua* and *H. helenae* appears to be positively correlated with the presence of *Phragmites australis,* while *I. salebrosa* is positively correlated with *Potamogeton natans*.

Aspects of reproduction with giant sperm in non-marine ostracods

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Compared to parthenogenesis, sexual reproduction evidently involves increased biological investments. These are even higher in cypridoidean ostracods, where the production and manoeuvring of giant sperm require an elaborate system of reproductive organs and where adjusted mating strategies need comparably high energetic investments.

We will present new insights into various aspects of reproduction with giant sperm in non-marine ostracods. On the cellular level, we will show differences in sperm lengths and morphology, and their distribution in the Cypridoidea, showing that a 'plesiomorphic sperm length' can tentatively be determined. Investigations of the reproductive behaviour of *Mytilocypris mytiloides* (Cyprididae, Cypridoidea) produced a robust dataset on mating anatomy, mating success, mating competition, sperm capacitation and sperm storage inside the female - data, that is essential to fully explore the evolution and function of giant sperm. An overview of up-to-date knowledge in still and moving images will be presented.

We will further provide new facts about the geological history and persistence of reproduction with giant sperm in ostracods.

The coastal evolution of the Tiber delta area during the last 2ky: a micropalaeontological and geochemical study of the Roman imperial Trajan Harbour (Tiber delta, Italy)

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The remains of the Trajan basin nowadays consist of a hexagonal lake, 3 km inland from the coastline. The huge artificial Trajan harbour, excavated in "*terrafirma*" and inaugurated in 112 AD, was part of the most important Roman port system of the ancient Mediterranean and was located in correspondence of the ancient coastline, close to the Tiber River mouth. Although of great historical and archaeological interest, the artificial basin was never studied before in a geo-archaeological perspective.

The basin hosts 5 m thick fine sediments, which were deposited from the moment of the excavation of the harbour until today. They record the environmental evolution of this coastal area and the human interventions on the natural landscape from the 2nd century AD until today. The aim of this study is to identify the main phases of environmental evolution of the area, trying to distinguish three main factors: the river regime, the coastline variations and the human impact. Several cores were drilled in the artificial lake and the results of multidisciplinary analysis on the longest core (LT6=4.27 m). High-resolution gamma-ray spectroscopy and magnetic susceptibility analyses were performed on the sediments of LT6. Pollen, Ostracoda and Foraminifera were extracted from the sediment core and stable isotopes analyses were performed on selected shells of Ostracoda (*Cyprideis torosa* and *Heterocypris salina*) and Foraminifera (*Haynesina germanica* and *Ammonia tepida*). The chronological framework is based on historical data and 4 AMS radiocarbon dates.

Autoecological data from ostracoda and foraminifera were used to characterise water inputs. Variations in foraminifer and ostracod frequencies and/or assemblages were related to prevailing marine or fresh-water inputs.

In the sediment core, 3 main factors have been distinguished, intertwined throughout the core:

1) The marine factor: it characterises the lower part of the core, indicating a marine lagoonal environment with both marine and freshwater inputs, these latter probably linked to floods. The foraminifer *H. germanica* and the ostracods *C. torosa*, *Palmoconcha turbida*, *Pontocythere turbida* dominate the assemblage, with *Ilyocypris* spp. and *Darwinula stevensoni* subordinate.

2) The river factor: it is detectable mostly in the middle part of the core, when the basin was probably not connected to the sea anymore. Low-salinity to freshwater fluctuations seem to be caused by delta progradation. Foraminifera lack in many samples, mostly where *Limnocythere inopinata*, *Cypridopsis vidua* and *Candona angulata* dominate.

3) The human factor: although human impact is detectable along the entire core, due to the proximity to the city of Rome, the harbour activities and the occurrence in the area of two salt pans exploited throughout the Medieval, the upper part of the core is where this factor is more evident. This could be linked to the land reclamation activities at the end of the XIX century are and the 1986 Chernobyl meltdown are all recorded by the microfossils and by the sediments respectively.

The correlations between scientific and historical data confirm that human impact deeply influenced the natural processes shaping the Tiber delta area and the coastal evolution since the 112 AD and that the sediments deposited in the basin recorded the existence of forgotten landscapes and events.

Ostracoda from a late Messinian sabkha environment in the central Anatolia Plateau (Çankiri Basin, Turkey)

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A 200 m-thick cyclic succession of continental gypsum layers, clays and sandy clays rich in gypsum with different thicknesses crops out in the Çankiri Basin (central Anatolian Plateau, Turkey) and represents the Bozkir Fm (Kaymakçi, 2000). It conformably overlays the early Messinian Suleymanli Fm. (MN13) and is truncated at the top by a deep erosional surface and by coarse fluvial Plio-Pleistocene deposits.

From sedimentological and geochemical analyses the deposition of the gypsum layers must be related to a continental environment with no connection with the sea. The gypsum crystals appear intruded within the clayey levels through capillarity. The Strontium isotopes results display a clear Eocene-Oligocene signal demonstrating their origin from ground-water dissolution of previously deposited marine evaporites (Palmer et al., 2004). The mineralogical analyses display tight variations in the clay mineral percentages suggesting arid/humid phases. For all these reasons the Bozkir Fm. represents an ancient continental sabkha depositional environment.

The Bozkir Fm. is well known in the literature as being constituted by barren sediments. Anyway, a 145 m-thick composite section was sampled for micropaleontological analyses and ostracods were found in scattered intervals. The palynological analyses depict an open grassland environment with halophilic aquatic elements. The ostracod association comprises 11 species: *Cyprideis* sp., *Candona* (*Neglecandona*) sp., *Pseudocandona* sp. juv., *Darwinula* sp., *Heterocypris salina*, *Ilyocypris* spp., *Zonocypris membranae*, *Limnocythere* sp. *Paralimnocythere* sp., and *Prolimnocythere torulata*. The assemblages are dominated by *Cyprideis* sp., which in the lower part of the section is the only species that occurs, often with very high frequency. In the upper portion the diversity increases and in some intervals the dominant taxon become *Ilyocypris* spp., mainly accompanied by Limnocytheridae, Candonidae and *H. salina*. The variation in the assemblage composition seems to point to changes from more concentrated to dilute water-bodies, possibly linked to a climate shift towards more humid conditions.

Similar climatic conditions have been recognized in the cyclical evaporite deposition and the sub-sequent Lago-Mare event occurred in the Mediterranean area in the late Messinian, during the Messinian Salinity Crisis. We suggest that the Bozkir Formation could represent the continental counterpart of the palaeoceanographical and palaeoclimatic variations that occurred during this event.

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The ostracod assemblage in the mid-Wenlock (Silurian) 'ostracod limestone', Saaremaa Island, Estonia

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The extensive documentation of Silurian ostracod faunas in Estonia is mostly based on sections representing middle or deeper shelf zones (Sarv & Meidla 1997). The ostracod assemblages in these strata are usually of relatively high diversity and rich in beyrichiocopes. Although a few very ostracod-rich intervals have been recorded in the sections of shallow shelf/near-reef zone in the Silurian of Estonia, the taxonomic composition of ostracod faunas in these strata has not been not studied hitherto. The majority of older references to the 'ostracod limestones' considered strata of lagoonal or restricted shelf setting, containing fossils that are nowadays attributed to 'leperditiid arthropods' and thus generally excluded from the Ostracoda.

Investigation of the so-called 'ostracod limestone' bed in the Abula section (Männik 2014) in northern Saaremaa (Jaagarahu Regional Stage, mid-Wenlock) has revealed a low-diversity association of ostracods that is dominated by *Eukloedenella pilosa* Sarv, 1980, accompanied by *Longiscula minuta* Sarv, 1980. Sarv (1980) considered both taxa to be typical of a peculiar late Wenlock upper shelf ostracod assemblage. In the upper Wenlock the ostracod taxa comprise a part of the beyrichiocope–bearing assemblages. The strata were tentatively attributed by Sarv (1980) to the shoal and upper shelf zones.

The two species recorded at Abula form rich accumulations in the topmost part of the Vilsandi Beds (Jaagarahu Formation). The carapaces of the same species, predominantly *E. pilosa*, are likely also serving as the cores of coated grains that are abundantly distributed on the bedding planes. Thin layers of 'ostracod limestone' in the lower part of this section occur as inter-beds in the lagoonal succession and very likely accumulated in the lagoon, influenced by episodic higher hydrodynamic activity. The poorly preserved valves on the bedding planes are of nearly uniform size and co-occur with rare, large, poorly preserved leperditiid arthropods. However, the population of *E. pilosa*, obtained from the same thin bed by disintegrating the limestone, contains a remarkable proportion of juveniles of several moult stages and suggests that the assemblage is autochtonous.

The species found in the 'ostracod limestone' at Abula likely represent the most near-shore assemblage of ostracods known from the Silurian of Estonia. The new material is remarkably older that the previous record (mid-Wenlock as opposed to late Wenlock). The particular assemblage is less diverse, compared to the assemblages recorded by Sarv in the late Wenlock. The structure of the assemblage suggests that the abundance of beyrichiocopes in the marginal areas of the Silurian basin was decreasing towards the shoreline.

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A new salinity transfer function for the brackish waters of the Wilderness Area, South Africa, based on Ostracoda and Foraminifera

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Within the project RAIN (Regional Archives for Integrated iNvestigations), which deals with interdisciplinary investigations of climate and coastal evolution in southern Africa focusing on the Holocene, microfossils are one of the main proxies to be used. Our first step is the setup of a modern training set on ostracods and foraminifers. One aim is the creation of a salinity transfer function for palaeoenvironmental reconstructions.

The first field campaigns in 2013 and 2014 started in the Wilderness Area, which is located on the Southern Cape coast within the overlapping area of summer and winter rainfall zones. We took 85 surface sediment samples in various watertypes and habitats along a salinity gradient from 0.7 to 36.4 with a median of 10.3 and a standard deviation of 11.9. Additional environmental parameters like alkalinity, current, dissolved-oxygen concentration, macrophytal cover, pH, Secchi depth, water depth and water temperature were measured and the habitats were described.

A multivariate analysis of faunistic and environmental data revealed salinity to be the most important driving factor for species distribution of ostracods, foraminifers and a merged dataset of both groups. We used the program C2 (Juggins 2007) for the setup of the salinity transfer function. A minimum of 300 individuals per sample and 2 % relative abundance per taxon constitutes the basis of the calculation. The dataset, comprising both ostracods and foraminifers, yields 60 samples and 49 species, 25 of them are ostracods. We used both groups of microfossils due to the dominance of foraminifers at high salinities and of ostracodes at lower salinities. The used method for the transfer function was Weighted Averaging Partial Least Squares with cross validation by Bootstrapping.

The best model shows a correlation of $R^2 = 0.81$ and a RMSEP = 6.7. We also modeled the transfer functions for ostracods and foraminifers separately. For the ostracods, 29 samples and 32 species were included. The performance of the model is $R^2 = 0.87$ and RMSEP = 6.3. For the foraminifers, 39 samples and 23 taxa produce values of $R^2 = 0.73$ and RMSEP = 8.8.

The foraminifer-based salinity transfer function shows the lowest performance of the three functions caused by a lower correlation of species distribution and salinity. Due to this, the combined ostracod- and foraminifer-based transfer function has a slightly lower performance than this one relying on ostracods alone. Nevertheless, we assume a transfer function based on combined counts of ostracods and foraminifers to be valuable for core sediments containing low numbers of ostracods. First micropalaeontological results from cores of the study area show non-synchronous fluctuations in ostracod and foraminifer abundances reflecting strong salinity changes in this coastal area.

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Late Holocene water balance changes in Groenvlei, a Southern Cape coastal lake in South Africa, as indicated by microfossil analysis

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Ostracods and foraminifers are the main microfossil groups used in a German-South African research project (RAIN) on late Quaternary climate change and coastal evolution in South Africa. We analyse sediment cores from lagoons, estuaries and coastal lakes in order to reconstruct changes in regional palaeoenvironmental conditions using a multi-proxy approach. Here we present the results of a 121 cm gravity sediment core from Groenvlei, covering the past 4,200 years. The closed coastal lake in the Wilderness Area does not posses a connection to the sea on the surface. In October 2013 we measured: salinity 2.3 psu, dissolved oxygen concentration 8.91 mg/l and pH 8.81. The sediments mainly consist of autochthonous carbonates. Surface sediment samples contain a low diversity salt-tolerant freshwater ostracod fauna with *Physocypria capensis*, *Gomphocythere capensis* and *Chrissia hodgsoni* dominating. The oligohaline conditions cause the dominance of ostracods as the main microfossils in the lake. The upper part of the core yields several hundreds to thousands of valves per cm^3, whereas very low abundances are characteristic for the older part.

Based on ostracod abundances and Renkonen similarity index, three zones can be distinguished: The basal Zone I (4200-2900 cal BP) is characterized by *Aglaiella westfordensis*, *Sarscypridopsis aculeata* and *Zonocypris* sp. Low abundances are shown by *Gomphocythere capensis*, *Loxoconcha* sp. and *Pontocypris* sp. at this part. A shift in the spectrum of species is remarkable in Zone II (2900-700 cal BP). *Aglaiella westfordensis* reaches more than 80 % in this section and coexisted with *Physocypria capensis* for the first time. The species dominant in Zone I reach their minimum relative abundance in Zone II. The upper Zone III (700 cal BP – present) yields a fauna as in the modern surface samples from Groenvlei.

Relying on a quantitative analysis of species distribution patterns and sedimentological parameters, we reconstruct the following development for the studied core: The basal part of the sediment core yields relativly high numbers of *Pontocypris* sp. pointing to mesohaline waters probably caused by marine influence. The decreasing trend of the brackish water ostracod *Aglaiella westfordensis* and the increasing porportion of the swimming taxa *Sarscypridopsis aculeata* and *Zonocypris* sp. combined with the rareness of species with marine origin within Zone I indicate the development of a dense submerged macrophytal cover caused by a lake level lowstand under dryer climatic conditions. The ostracod-based salinity transfer function reveals higher values than today. The dominance of *Aglaiella westfordensis* in Zone II is interpreted as a result of a lake level rise and disappearing of macrophytes together with decreasing pH values and a decline in salinity under more humid conditions. Zone III is characterised by oligohaline conditions and the same salt tolerant freshwater species as today. Salinity variations are also indicated by changes in the mineralogy. During periods of high salinities aragonite and dolomite are the dominant carbonate minerals, whereas times of lower salinities are mainly characterized by the deposition of calcite. The general lack of autochthonous foraminifer associations points to a continuous separation from the sea. Hence, we assume salinity to be mainly a climatic signal reflecting changes in precipitation/evaporation ratio. However, marine influence through saline groundwater inflow may play a role in the oldest part of the sequence. A late Holocene tendency of increasing precipitation is concluded.

Niche and spatial effects on a highly diverse tropical ostracod metacommunity

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Patterns arising from the neutral theories of biodiversity suggest that the heterogeneous spatial distribution of species does not need ecological explanations related to environmental factors and species adaptations, but just random ecological drift. However, these theories have been falsified based on field and experimental data, and many non-random patterns have been observed relating ecological gradients to metacommunity structure. Yet most studies have been carried out in temperate habitats, while other works suggest that species-rich tropical environments might be less prone to local (niche) effects on species distributions. Here we tested the relative influence of environmental and spatial factors on an ostracod dataset collected from 80 sites in northeastern Thailand, encompassing a wide variety of water bodies and harbouring 57 species in total. Variation partitioning analysis showed a predominant significant effect of habitat type, conductivity and pH, together with minor spatial effects. Ricefields appeared as the most distinct habitat type sampled, with high relative abundances of *Pseudocypretta maculata* Klie, 1932 and *Cypretta seurati* Gauthier, 1929 compared to other habitats. Overall, our results suggest that both strong niche effects and dispersal constraints are affecting ostracod community assembly in tropical freshwater ecosystems.

Ecology of benthic microfossils and depositional environments of Late Triassic (Rhaetian) deep neritic deposits in the Northern Calcareous Alps (Austria) – preliminary results.

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The Rhaetian Zlambach Formation was previously suggested to have accumulated under stable normal marine conditions in a deeper subtidal to upper bathyal environment bordering the so-called Meliata Ocean. Slumping structures and turbiditic beds are suggestive of a toe-of-slope to basin environment. Previous estimates of the maximum water depth of the Zlambach Formation vary between 50m and 500m. Preliminary results of the present study, particularly the absence of deep marine (bathyal) ostracods, are suggestive of less than 200m water depth. A high resolution micropalaeontological and geochemical analysis of the Zlambach Formation of the Rossmoosgraben section near to Bad Goisern, Austria, has demonstrated significant environmental changes which were controlled by sedimentary cyclicity and changing water depth. The lower and middle part of the Zlambach Formation at the Rossmoosgraben section (Rhaetian 2-3) shows 4 to 6 meters-thick depositional cycles consisting of thick clayey and silty marls in the lower parts and intercalated thickening-upwards micritic limestones in the upper parts. Intercalations of detrital limestones with abundant shallow-water foraminifera, and geochemical proxies for the input of terrigenous clastics as well as the carbonate content indicate turbiditic activity at the top of the cycles, probably caused by sea level fluctuations. Short-term sea level changes are also recorded in age-equivalent intra-platform basin deposits of the Northern Calcareous Alps (Kössen Formation). The microfossil assemblages of the Zlambach Formation also display cyclic changes. The ostracods show increasing total abundance and species diversity from the base to the top of each cycle and changes in the relative proportion of taxa. Relatively small, smooth and thin-shelled healdiids and bairdiids are abundant in the lower part of each cycle. Larger thick-shelled and sculptured healdiids and bairdiids occur preferentially in the upper part of the cycles. At present it is not clear if this change is due to redeposition or environmental change. Very distinct changes are recorded by the foraminifera assemblages and bioturbation patterns. Predominantly primitive agglutinated forms together with smaller nodosariid taxa occur in the lower parts of the cycles, while the relative abundance of other lagenids increases significantly towards the top of the cycles. Laminated shales in the lowest parts of the cycles point to oxygen-poor conditions, while the middle and upper parts show trace fossil associations indicating higher oxygen concentrations. Preliminary data on foraminifera and carbon isotope values as well as intervals with millimeter-scale laminations in the upper Zlambach Formation (Rhaetian 3) point to major environmental disturbance in the late Rhaetian.

Biogeographical differences in stable oxygen and carbon isotopes of *Cytheridella* in the Neotropics: the case of the Florida area

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Geochemical signatures of ostracod valves have become important proxies for paleohydrological conditions. The environmental factors and mechanisms which govern the chemical composition ($\delta^{18}O$, $\delta^{13}C$, Mg/Ca, Sr/Ca) are, however, not yet fully understood, and species specific data containing information about the hydrological background and associated hydrochemistry of recent sampling localities are rare.

Within the project FWF P26554 we investigate the biogeography and ecology of the Neotropical ostracod *Cytheridella* from recent freshwater habitats. *Cytheridella* covers a wide geographical range comprising subtropical and tropical regions from approximately 30°N to 30°S on the American continent. This gives us the opportunity to examine the isotopic composition of ostracod valves of *Cytheridella* and their host waters along the whole geographical range.

We used water samples from different rivers and other freshwater habitats from Florida and Mexico sampled in August 2014 to analyze their isotopic composition. In addition, valves of *Cytheridella* from surface sediment samples from the same sites were also analyzed for stable oxygen and carbon isotopes.

First data of stable isotope measurements of ostracod valves from Florida show a total range from -2.87‰ to 1.59‰ for $\delta^{18}O$ and -9.08‰ to -3.40‰ for $\delta^{13}C$. The values differ between the sample sites but reside in the dimension of their host waters with a constant positive vital offset. The offset differs between the samples ranging from 0.92‰ to 5.63‰ above theoretical calcite formed in equilibrium.

We already find differences in the isotopic composition of *Cytheridella* in Florida. This gives us an indication for changing environmental conditions at a small regional scale. Further investigations can provide more information on the geographical differences of the isotopic composition of *Cytheridella* and therefore enhance the understanding if ecological requirements of an ostracod species may change within its range. These may occur, e.g., from the center to the edge, according to ecological gradients. Another important aspect is which impact higher ecological stress at the edges could have.

Extending the reach of precise paleoenvironmental reconstructions into deep time using community-wide trait distributions of ostracods

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Taxonomically-defined communities of microorganisms vary so precisely with the physical environment that statistical models to transform species abundances into records of past environments have been successfully used to reconstruct past temperature, salinity, acidification, nutrification, and even sunshine. Yet, these methods all rely on using varying abundances of extant species, whose niches across environmental gradients can be known with certainty, to produce paleoenvironmental records. If species' traits vary as precisely and predictably as do species' abundances, then these methods could be applied to records with extinct species, enabling precise reconstructions in deep time.

Here, we demonstrate that the averages of seventeen traits of ostracod carapaces, weighted by the community-wide abundances of species, varies more precisely with environmental gradients of salinity, alkalinity, and dissolved oxygen than do abundances of species in lake environments on the Bahamian islands New Providence, San Salvador, and Rum Cay. We then develop unique transfer functions for salinity, alkalinity, and dissolved oxygen based on community-weighted traits and apply them to preserved ostracod assemblages from Holocene sedimentary archives in lakes on the same three Bahamian islands, and find that these produce more precise reconstructions than species abundance functions. We have also developed a new online database for ostracod carapace traits to facilitate this new method and other trait-based approaches. The greater precision in the relationships between species' traits rather than abundances across present and past environmental gradients demonstrates that precise paleoenvironmental reconstructions need not be limited to the Quaternary, but may be possible throughout the Phanerozoic.

Ostracoda of shallow floodplain water bodies in the lower reaches of the Ob River in the taiga/forest-tundra transition zone of the Western Siberian Lowland, Russia

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The knowledge of recent non-marine ostracod fauna of the northern part of West Siberia (a large plain between the Ural Mountains and the Yenisei River experiencing currently excessively large warming) is still relatively poor. The present study aimed at contributing to the acquisition of ostracod distributional data in the Arctic which is in line with recently recommended key topics for future research on climate change effects on freshwater biodiversity in northern regions.

Material was collected in June-July 2009 from 19 sites located on the left bank along the main riverbed of the lower Ob River, and extending ca. 170 km from the forest-tundra environs of the town of Labytnangi in the north (66°40' N, 66°32 E, ca. 220 km to the east of the mouth of the Ob River) to the taiga zone near the village of Gorki in the south (65°13' N, 65°10 E), within the Russian Yamal-Nenets Autonomous District. The study area is an extensive floodplain with absolute heights up to 80-120 m and continuous permafrost, characterised by a subarctic climate with the mean annual temperature of -6°C (February and July mean temperatures: -22.4°C and 14.4°C, respectively) and the total annual precipitation of 425 mm. Samples were taken semiquantitatively from diverse geomorphological types of large river flood stage waterbodies (secondary and tributary channels, internal drainages, lentic environments and wetlands) variously connected to each other and to the main river. In addition, four impacted urban waterbodies were also sampled.

The studied collection provided abundant and diversified ostracod record, consisting of ca. 4300 mostly juvenile individuals. Only one sample did not yield living ostracods (although empty valves were present), in other samples the mean ostracod abundance equalled to 238 (min. 3, max. 1181). A total of 24 species were identified, although some were questionably assigned to species or only to generic level due to the juvenile stage not attributable with certainty to the identified adults. The mean species richness per site was 5.5 (min. 2, max. 10), and the most numerous and/or common species were *Cypris pubera* (13 sites, 54.7 % of the total abundance), *Amphicypris nobilis* (9 sites, 3.9%), *Eucypris crassa* (7 sites, 2.8%) and *Cyprois marginata* (only 3 sites but 27.0%). It is worth to note that *E. crassa*, known as an asexual species, was represented at each of its site in the studied area by both sexes. Four of the collected species have not previously been recorded in the region of Western Siberia: *Candona neglecta*, *Candona weltneri obtusa*, *Cypria sywulai* and *Paralimnocythere relicta*, while as many as 18 species appeared new to the region of the lower Ob River.

One major assemblage group (as well as two assemblage pairs and one single assemblage clearly separated from the major group) were recognised by clustering classification and multi-dimensional scaling ordination. The core group comprised assemblages from 11 sites, displayed high average mutual similarity of 71.3% and was dominated by *C. pubera* (with the mean relative abundance of 76.3%), associated with *A. nobilis* (7.8%) and *E. crassa* (3.1%).

Taxonomic diversity of the studied assemblages was of expected range based on the inventory of 72 freshwater species of the region of Western Siberia.

Ludlow (Silurian) and Givetian (Devonian) ostracods and conodonts from the İstanbul Zone (Kartal and Tuzla PenInsula), NW Anatolia

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The İstanbul Zone of the Pontides comprises a thick Palaeozoic sedimentary sequence extending from Ordovician into the early Carboniferous. Ostracod and conodont faunas indicative of the Ludlow Series (Silurian) and Givetian (Devonian) were recovered from the Sedefadası Member of the Pendik/İstinye Formation, and the Bostancı and Yörükali members of the Büyükada Formation. The ostracod faunas have affinities with European, American and African assemblages.

The Sedefadası Member consists of dark grey, thin- to medium-bedded micrite and biomicrite locally containing black or dark-grey shale intercalations. An ostracod fauna consisting of *Neobeyrichia*, *Aechmina*, *Acratia*, *Nondelosia*, *Bollia*, *Clavofabella* and *Microcheilinella* was obtained from two core samples of the Sedefadası Member in Kartal/İstanbul. This member is considered to be of late Ludlow-early Lochkovian age in previous publications. However, its ostracod assemblages have affinities with late Ludlow Series ostracod assemblages of the Baltic Region.

Limestone samples from a short seashore outcrop containing the uppermost part of the Bostancı Member and lowermost part of the Yörükali Member of the Büyükada Formation at the Tuzla Peninsula/İstanbul yielded a Givetian conodont and ostracod fauna. The Bostancı Member consists of bluish grey, black thin- to medium-bedded, nodular limestones with thin, light-brown shale inter-beds. The Yörükali Member is composed of thin- to medium-bedded, black to dark gray lydite (i.e. cherts) and pink to yellowish-gray, silicified shales to claystone with chert inter-beds. The conodont fauna indicates the *hermanni-cristatus* to *disparilis* biozones of the Givetian. Entomozoacean ostracods were previously found in the Yörükali Member. The ostracods studied, belonging to the orders Palaeocopida and Podocopida, were originally observed in the Bostancı and Yörükali members. They are represented by *Tricornina*, *Acratia*, *Hanaites*, *Ctenoloculina*, *Skalyella* and *Microcheilinella*. These genera, except for the European genus *Skalyella*, have been observed in the North American, European and North African Devonian units.

Ambient Inclusion Trails in Palaeozoic arthropods (Phosphatocopina and Ostracoda)

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Hollow microtubular structures with a euhedral pyrite crystal at their upper termination have been found in the phosphatocopine *Hesslandona* sp. from the Cambrian (Furongian) of northern Poland and in the metacopine ostracod *Cytherellina submagna* from the Early Devonian (Lochkovian-early Pragian) of Podolia, Ukraine.

These microtubular features are here interpreted as ambient inclusion trails (AITs). AITs are thought to form when mineral crystals, typically pyrite, are impelled to migrate through apatite or cryptocrystalline chert under fluid/gas pressure, possibly generated by the decay of organic material (McLoughlin et al. 2007). AITs have mostly been reported from Precambrian rocks. The oldest examples are almost 3,500 Ma from the Apex Basalt and Strelley Pool Formation of Western Australia, with younger well-preserved examples found in the ~1900 Ma Gunflint Formation of Canada and the ~570 Ma Doushantuo Formation of China (Wacey et al. 2008 and references therein). In the Palaeozoic rock record AITs appear to be extremely rare, known only from the lower Cambrian Soltanieh Formation of Iran, and ~390 Ma old Achanarras Limestone of Scotland, preserved in fish scales (Wacey et al. 2008).

In this study AITs occur in phosphatocopine and ostracod specimens that have been secondarily phosphatized. In *Cytherellina submagna*, AITs occur within the internal coating phosphatic layer and are visible due to the dissolution of the calcite carapace. It is also notable that specimens of *C. submagna* provide unique evidence of three-dimensionally preserved ostracod soft parts (Olempska et al. 2012). In phosphatocopines, the AITs are preserved inside the phosphatized shell and are visible on the surface as half-open tubules with pyrite grains at the distal end or as tubules with longitudinal striations. Longitudinal striations and polygonal cross sections are characteristic of AITs and are thought to record the movement of the migrating angular pyrite crystal (Wacey et al., 2008).

There is ongoing debate as to whether AITs are purely inorganic structures or whether a biological component is necessary for their formation. This new material from Poland and Ukraine is the first record of exceptionally preserved AITs occurring in phosphatised arthropods. The intimate occurrence of AITs with arthropod body fossils supports the idea that a biological component (i.e. decomposition of soft tissue) is necessary for the formation of AITs.

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Ostracods meet bacteria: Species-specific microbiome of freshwater ostracods

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Microorganisms are arguably the most abundant and diverse group of living organisms. Bacterial communities inhabit all range of environments, from extreme outer conditions to the inside of multicellular organisms. Until recently it was difficult to estimate richness of microbial world associated with animal hosts. However, advent of the new generation sequencing methods and advances in metagenomics allowed revealing the richness of microorganisms in natural environments. The relationship between microbiome and the host has been a subject of intense studies in the last decade. Numerous reports argue between existence of species-specific and general microbiome. Here we present results backing the hypothesis of species-specific microbiome of freshwater ostracods. We took an advantage of culturing two species *Sclerocypris sarsi* and *Potamocypris mastigophora* that were raised from dry mud collected in Makgadikgadi Pan, NE Botswana. The ostracods were kept in a permanent semi self-sustaining culture under laboratory conditions in the same water tank. Analysis of bacterial 16S rDNA gene by the high resolution melt technique revealed differences in the overall microbiome profile between the two species belonging to one family Cyprididae. To our knowledge, this is the first analysis of microbial communities in ostracods, and the first one showing the difference in the microbiomes between co-cultured species.

Ecology and species diversity of Ostracoda (Crustacea) in Ağrı region (East of Turkey)

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A total of 115 water bodies with 10 different habitat types were sampled during the summer of 2014 and 52 taxa (35 of which living) were found: *Candona neglecta, Cyclocypris ovum, Cypria ophthalmica, Cypridopsis vidua, Cypris pubera, Eucypris virens, Fabaeformiscandona acuminata, F. brevicornis, F. fabaeformis, Herpetocypris chevreuxi, H. helenae, Heterocypris incongruens, H. salina, Ilyocypris bradyi, I. decipiens, I. gibba, I. inermis, I. monstrifica, Limnocythere inopinata, Paralimnocythere relicta, Plesiocypridopsis newtoni, Potamocypris arcuata, P. fallax, P. similis, P. smaragdina, P. variegata, P. villosa, Prionocypris zenkeri, Pseudocandona albicans, Psychrodromus fontinalis, P. olivaceus, Stenocypria fischeri, Tonnacypris lutaria, Trajancypris clavata* and *T. serrata*. *Fabaeformiscandona acuminata* is a new report for the Ostracoda fauna of Turkey while 29 species are new for the region of Ağrı. After this research, the total numbers of living ostracod reported from Ağrı reached 39 species. Canonical Correspondence Analysis explained 73.9% of the correlation between 18 most frequently occurring species and five environmental variables with a low variance (8.9%). Water temperature ($p = 0.042$, $F = 1.743$) and elevation ($p = 0.002$, $F = 3.721$) were found to be the most effective factors on ostracods. UPGMA Cluster analyses displayed species in five groups based on their occurrence frequencies. The most common 5 species (*Candona neglecta, Heterocypris incongruens, Ilyocypris bradyi, Heterocypris salina, Limnocythere inopinata*) were clustered in group-A followed by others (B-E). Although the number of ostracods (39 species) is relatively higher than the average numbers of the species in other regions, we believe that the actual species diversity is much higher than what we know. This is mostly because of our limited sampling time. Therefore, the results may not be generalized at the moment. Further possibilities are discussed.

Ostracode Distribution in Lakes in the Bahamas as a Response to Sea Level and Climate Change

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Lakes on carbonate platform islands such as the Bahamas display wide variability in morphometry, chemistry and fauna. These factors are ultimately driven by climate, sea level, and carbonate accumulation and dissolution. A model dividing lakes into either constructional or destructional formational modes has been developed using both qualitative and quantitative data. This model shows that lake formation is influenced by the hydrologic balance associated with climatic conditions that drives karst dissolution as well as the deposition of aeolian dune ridges that isolate basins due to sea-level fluctuations.

The model was tested as a predictive tool for faunal distribution, using the microcrustacean group Ostracoda. We used an ostracode database comprised of 11 species from the 52 lakes that were used in constructing the lake model. Ostracode counts were at least 400 right valves per lake. Live/dead studies indicated that the death assemblage faithfully records the living community. A non-parametric multi-dimensional scaling model using the ostracodes shows that, just like the physical and chemical model, blue holes (i.e. cave (inland) or underwater sinkhole) tend to be very similar in species composition. The interdunal depressions and cutoff lagoons have similar assemblages. The two anomalies in the karsted depression are clustered together. These ostracode communities have either low or no *Cyprideis americana*—a widespread, cosmopolitan species found in almost all lakes. Instead, they are dominated by *Hemicyprideis setipunctata* that is an ecological competitor with *C. americana* and found in almost all lakes but at higher abundances in the blue holes. While many people attribute species distributions to abiotic drivers, this lake model is able to separate physical vs. biological variables and in this case, is able to inform us of an important case of competition happening that would not have been normally detected.

Quantifying the origins of a pelagic lifestyle in ostracods

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Coupled with evidence from depositional setting, faunal associates and functional morphology, the palaeogeographical distribution patterns of ancient marine organisms can be used as to test mode of life. Thus, fossil organisms that are interpreted to have been planktonic throughout their lifecycle (e.g. graptolites), and those with a long-lived planktonic larval stage (e.g. the planula larvae of corals) typically have wide intercontinental distribution, whilst those that have a demersal and short-lived larval stage (e.g. brachiopods), and those that are exclusively benthic (e.g. podocope ostracods) generally have a more restricted biogeographical distribution.

Here we develop an independent test of fossil ostracod autoecology using modern distribution patterns to visualize 'geographical domains' for pelagic and benthic lifestyles. These data are statistically filtered in order to match the ranges of geography and bathymetry between Silurian and modern forms. Our analysis decisively identifies Silurian myodocopes with ranges overlapping with modern pelagic ostracods. Though predicated on ostracods, our approach is potentially applicable to analyzing the patterns of any putative arthropod zooplankton in the fossil record where the ecology of modern representatives can be readily determined. Furthermore it may also form a guide to identify fossil zooplanktonic arthropods (like some Ordovician trilobites) that have no modern representatives.

Distribution of Recent ostracods in inland waters of the Mediterranean area (Greece, Southern Italy, and Malta)

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In the frame of a wider survey aimed at investigating the inland water crustaceans of the Mediterranean area, a case study concerning non-marine ostracod fauna collected in Mediterranean inland waters is here presented.

The study was carried out in 369 water bodies (natural or artificial, permanent or temporary, lentic or lotic), which are representative of the diverse range of freshwater habitats. Forty-eight sites were located in Apulia, 250 in Sicily, 7 in the Maltese islands, and 64 in Greece. A total of 470 ostracod samples were collected between 2002 and 2014. Sites were selected to encompass the most widespread types of temporary and permanent freshwater aquatic habitats (i.e., pools, ponds, flooded fields, lakes, wells etc.). For most of the sites water temperature, conductivity and pH were measured.

The analysis of samples from the new surveys yielded a total of 47 ostracod species and 18 taxa identified to supraspecific level, belonging to 7 families (Candonidae, Cyprididae, Darwinulidae, Hemicytheridae, Ilyocyprididae, Limnocytheridae, and Notodromadidae).

The most frequently encountered taxa were the *Eucypris virens* species complex (148 sites) and *Heterocypris incongruens* (84 sites), followed by *Sarscypridopsis aculeata* (42 sites). Seventeen taxa have been found only in a single site each.

Of particular interest is the occurrence of *Ilyocypris getica*, a species new to the Italian ostracod fauna and currently exclusively recorded from a single pool on Ustica island (Sicily) and from a temporary pond located on Crete island (Greece).

The obtained results show the presence of a highly diversified ostracod fauna in Mediterranean temporary inland waters. The analysis of data revealed that the most influent environmental factors in determining species distribution in the study area are conductivity and altitude, although no clear biogeographical and ecological patterns have been found. This may depend on the fact that sampled species are generally characterised by broad ecological tolerance, and because of the high frequency of few taxa. However, notwithstanding a large overlap, a significant difference in species composition was observed between mainland Sicily and its surrounding islands and Apulia.

Ostracod fauna associated with *Cyprideis torosa* – an overview

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Cyprideis torosa is a euryhaline species originating from brackish waters of coastal areas. It often dominates oligohaline lagoons but only in hypersaline environments does it occur monospecifically. Due to its broad tolerance to salinity, study of the associated fauna allows the detection of salinity variations in ancient ecosystems in more detail. *Cyprideis torosa* occurs with other freshwater and marine as well as brackish ostracods. However, it is typically accompanied by taxa tolerant of ecological variations and able to migrate along salinity gradients. In athalassic inland waters, the composition of the associated fauna is highly variable and based mainly on salinity, size, structure and permanence of the water body. Climatic conditions and dominating ions may also play an important role. Waters with low salinity are mainly colonized by freshwater ostracods, whereas marine species migrate to near shore ponds with higher salinity. Commonly, ostracods of various origins appear together in one ecosystem, especially such at mesohaline waters. We present examples of athalassic waters from Central Germany, Turkey and Kazakhstan to identify the controlling factors of the specific association. In the Mansfelder Lake area (Central Germany), *C. torosa* occurs together with 21 freshwater species and *Cytheromorpha fuscata*, another brackish species. Salinity ranges from freshwater to c. 8. In the restricted hyposaline (salinity c. 20-30) lagoon of Ainos (Turkey) as well as the Baltic Sea coast, *C. torosa* is accompanied by marginal marine taxa such as *Loxoconcha* spp. and *Leptocythere* spp. In the Aral Sea (Kazakhstan), *C. torosa* is associated with two marginal marine species (*Loxoconcha immodulata*, *Tyrrhenocythere amnicola*), one brackish species (*Leptocythere cymbula*) and three freshwater species (*Limnocythere innopinata*, *Limnocythere aralensis*, *Candona* sp.). This assemblage existed under a salinity of around 10 before starting the drainage of the lake since 1960. The monospecific *C. torosa* association of the early Holocene oasis of Tayma (NW Saudi Arabia) may be explained by hypersaline conditions. In all these sites foraminifera also occur, but in a very low diversity.

Late Quaternary lake history of the Siebleber Senke (Thuringia, Central Germany) – methods of palaeoenvironmental analysis using Ostracoda

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We test several methods of ostracod-based palaeoenvironmental reconstruction using indicator species approach, mutual ecological/climatic range methods, transfer functions, modern analogue technique and morphological variation within *Cyprideis torosa* in reconstructing the site evolution of a late Quaternary small lake basin. Sediment sections containing a diverse ostracod fauna were studied and compared with those from modern water bodies of Thuringia. Palynological investigations were executed to reconstruct the environmental conditions in the catchment area and for obtaining a biostratigraphical framework. The brackish water ostracod species *Cyprideis torosa* as well as the foraminifer *Haplophragmoides* indicate phases of salty groundwater influence, fed by salt bearing sediments of the Triassic basement. The other microfossil taxa of the succession, however, reflect only low variations of salinity and temperature. Environmental changes in salinity, temperature and ecological stability indicated by microfossils and pollen are caused by an interplay of climatic shifts and the local geological and hydrological setting.

Ostracod ecology and response to human activities in lakes of the middle and lower Yangtze River plain

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The middle and lower Yangtze reaches are known as the 'country of a thousand lakes'. However, with the development of extensive agriculture, fishing, farming and urbanization during recent decades, most lakes in this area have undergone eutrophication. The deterioration of drinking water in lakes due to cyanobacterial blooms and pollution has become a serious socio-economic problem. Such kinds of human activities have seriously damaged the aquatic ecosystems leading to a decrease of biodiversity, and threating the local human health.

An increasing body of evidence suggests that microorganisms such as ostracods, protozoa and diatoms are sensitive to environmental change and have been used as excellent proxies in ecological and paleoecological research, facilitated by their high species diversity, quick response to environmental changes and distinct morphological characteristics. Growing research has suggested that freshwater ostracods have potential as indicators for water quality in lakes, and have been suggested to respond to anthropogenic eutrophication, acidification and contamination.

This study investigated ostracod ecology and their potential role as bioindicators for water quality of lakes within the middle and lower Yangtze River plain. The first two axes of the RDA ordination accounted for 24.87% of the total variance (while axis 1 explained 23.0%) and 92.3% of the variance of species-environment relations. It is showed that the ostracod community compositions are closely related to water pH ($p=0.004$) and nutrient level. Thus an ostracod-based water pH transfer function model was developed to allow palaeoenvironmental reconstruction.

A Miocene saline lake evolution: Ostracods from Moneva (Ebro Basin, Spain)

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A Middle Miocene saline lake evolution is studied in a 13 m outcrop of the Moneva section (Azuara subbasin, Ebro Basin, Spain). The Ebro Basin is a part of the late southern foreland basin of the Pyrenees that became a non-marine closed basin since the Late Eocene to the late Miocene. A multidisciplinary approach has been undertaken including results from the occurrences of molluscs, pollen, charophytes, foraminifers, vertebrates, as well as from geochemical signatures (Anadón *et al*., in prep.). Here, we present the results of the investigation of ostracods from 89 samples. The ostracod assemblages (35060 valves) show a very low diversity, as typical of stressed environments. The ostracod assemblages are composed, as common species, of *Cyprideis* gr. *torosa* (Jones, 1850), *Heterocypris salina* (Brady, 1868), *Mediocytherideis (Sylvestra)* cf. *posterobursa* Doruk, 1973, *Mediocytherideis (Sylvestra)* sp., and *Mediocytherideis (Mediocytherideis)* sp. Very rare species are: *Candona* sp., *Candonopsis kingsleii* (Brady & Robertson, 1870), *Darwinula stevensoni* (Brady & Robertson, 1870), *Eucypris* sp., *Heterocypris incongruens* (Ramdohr, 1808), *Heterocypris* sp., and *Ilyocypris* gr. *gibba* (Ramdohr, 1808). *C.* gr. *torosa* is the dominant species throughout the section, while *H. salina* only dominates in particular samples of the mid part of the section. The palaeoenvironment is characterized by the dominance of *C.* gr. *torosa* accompanied by *H. salina*, which is interpreted as marginal marine/estuarine-like, eurihaline waters (2-16.5 ‰ salinity). The very low diversity is indicative of stressed environment, probably caused by salinity oscillations (hydrological instability). The lower part of the section shows the occurrence of leptocytherids *(Mediocytherideis)*, which is indicative of the influence of different waters, inside the mesohaline/polyhaline range. These leptocytherids are more or less irregularly present through the four lower meters of the section. In the interval of 1-1.5 m there is the only increase of diversity in the whole series, with abundance of leptocytherids and the entrance of mostly oligohaline species (*I.* gr. *gibba, D. stevensoni, C. kingsleii*), evidencing the only low-salinity influence in the series. The single change of dominance (*H. salina* > *C.* gr. *torosa)* is found at 7.70 m indicating a higher chloride content in these waters.

The number of ostracods displays maxima of around 500 valves/sample and the nO value (# indiv./gram) shows two maxima at the lower part and top of the series, with two decreasing trends in the middle part of the section. The subgenera *Mediocytherideis (Mediocytherideis)* and *Mediocytherideis (Sylvestra)* appeared during the Serravalian in the Mediterranean and Paratethys. After the closure of the Mediterranean/Paratethys connection, the genus *Mediocyterideis* was adapted to brackish to shallow marine environments in both regions (Ligios et al., 2008).

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(Un)expectedly high genetic diversity of *Heterocypris incongruens* (Ostracoda, Cyprididae) from Iberian all-female populations

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A cosmopolitan morphospecies *Heterocypris incongruens* lives in small temporal freshwater bodies, surviving droughts in the form of resting eggs. Wind dispersal of eggs could determine the metapopulation dynamics of this species, with frequent extinctions of local populations and colonisations. Previous research based on allozyme variability has reported the high clonal diversity within this species. Here, on the basis of mitochondrial DNA cytochrome oxidase subunit I (COI) and nuclear 28S rDNA sequencing data, we provide a picture of *H. incongruens* genetic diversity in a random selection of seven sites in southern Portugal and central Spain. High genetic distances, based on both 28S rDNA and COI sequences (up to 2% and 25%, respectively) among the all-female populations sampled in a variable spatial scale were observed. The revealed genetic diversity did not show any geographical pattern. The high level of divergence among the identified haplotypes considerably exceeds the value commonly acknowledged as an average in most animal species. However, in species belonging to the ostracod family Cyprididae such high genetic divergence is not unexpected, as previous studies have documented. An exceptionally high number of cryptic species discovered within this family may strongly suggest that also *H. incongruens* constitutes a complex of several cryptic species.

Environmental properties and micropalaeontological investigation of tertiary sequences in Çorlu-Muratli-Lüleburgaz-Babaeski (Southeastern Thrace, Turkey)

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During this study, micropaleontological evaluation of the Tertiary sequences of Çorlu-Muratlı-Lüleburgaz-Babaeski (Southeastern Thrace, Turkey) region was made on two washing borehole samples, collected by MTA (Mineral Research and Exploration) measured sections and point samples taken from the around of Lüleburgaz-Babaeski, Babaeski-Edirne, Tekirdağ-Hayrabolu road, Çorlu-Türkmenli and Silivri regions. Yellowish-greenish colored claystone, yellowish-beige colored sandstone, leave-traced sandstone composed of lignite, organically colored clay, siltstone (Danişmen formation) and well-preserved ostracod fauna gained from the silts (Ergene formation) commonly found on the upper levels of the pile along with some micro-mollusca at some levels were observed. Based on the microfauna included in the measured samples, point samplings and borehole samples, the age of the sequence studied was determined in the range of Early Oligocene-Pliocene. Species found in Oligocene include ostracods (*Cytheromorpha zinndorfi*, *Cladarocythere apostolescui*, *Neocyprideis apostolescui*, *N. williamsoniana*, *Hemicyprideis montosa*, *H. elongata*, *H. helvetica*, *Serrocytheridea eberti*, *Sphenocytheridea gracilis*, *Cytheridea pernota*, *C. crassa*, *Cushmanidea scrobiculata*, *Krithe angusta*, *Loxocorniculum decorata*, *Hirschmannia* sp., *Loxoconcha* sp.1, *Candona* (*Pseudocandona*) *fertilis*, *Candona* (*Pseudocandona*) sp., *Candona* (*Lineocypris*) sp., *Ilyocypris boehli*, *I. cranmorensis*, *Novocypris striata*, *Eucypris pechelbronnensis*,*Virgatocypris tenuistriata*, *Verticypris jacksoni*, *Cypridopsis soyeri*) and micro pelesipod and gastropods (e.g., *Avimactra*, *Viviparus*, *Valvata*). Meanwhile, *Candona* (*Caspiocypris*) *alta*, *I.bradyi*, *E. dulcifons*, and *H. salina* were described from the Late Miocene-Pliocene. Among the ostracod genera, the genus Krithe represents infranereitic-bathyal range when others represent different ranges as *Cushmanidea* epineritic, *Cytheridea* lagoon-epineritic, *Cytheromorpha*, *Hemicyprideis*, *Hirschmannia*, *Loxoconcha* lagoon-littoral, *Cladarocythere*, *Neocyprideis* lagoon, *Ilyocypris* lacustrine-lagoon, *Novocypris*, *Eucypris*, *Virgatocypris*, *Verticypris*, *Heterocypris*, *Candona* *(Pseudocandona)*, *Candona* (*Lineocypris*), *Cypridopsis* lacustrine. Besides, three genera (*Avimactra*, *Viviparus* and *Valvata*) belonging to pelecypod and gastropods represented lagoon and lacustrine environment, respectively. Results of the evaluation of this fauna based on the samples used here revealed that lagoon and lacustrine environment ostracods were generally found in the marl, siltstone and claystone of the lower and upper levels of lignite cuts in borehole carrots. My study, which was compared with the other studies done in Thrace Basin, northwestern Europe, Paris Akiten Basin, Belgium, England, Romania and Sweeden, showed that age-environment relationship was similar.

Langhian (middle Miocene) ostracod assemblage from the Carpathian Foredeep

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The elongate depression of the Carpathian Foredeep, situated between the Carpathians and the Bohemian Massif, originated in the early Miocene. Its marine ostracod fauna has been intensively studied biostratigraphically in the 20th century. Palaeeoecological and palaeobiogeographical aspects of the ostracods and their affinities to Paratethyan and Mediterranean faunas were addressed at the beginning of the 21th century.

The marine ostracod assemblages of the subtropical to tropical Carpathian Foredeep sea have been examined from the Lomnice LOM1 core, of the Czech Republic. Green-brown to grey-green calcareous clay and clayey siltstone occur in the interval 14.6 Ma (the first occurrence of *Orbulina* spp.) to 13.42 Ma (the last occurrence of *Sphenolithus heteromorphus*) (Scheiner *et al*. 2015). Our analysis focused on the taxonomy, palaeoeoecology and diversity of the ostracod species and the stratigraphical distribution of these taxa and individuals in the core.

The assemblage is composed of fifty-two species showing a cyclic change in abundance of individuals. *Aurila punctata* (Muenster, 1830) is the most frequent and the most abundant species, representing 25% of all picked individuals. Its abundance consistently increases towards the top of the borehole, but a generally rare occurrence of its adults can correspond to a model involving post-mortem transport (Boomer & Eisenhauer 2002). The group of infralittoral, circalittoral to bathyal species (Gross 2006), consisting of *Olimphalunia plicatula* (Reuss, 1850), *Buntonia subulata subulata* Ruggieri, 1954, *Loxocorniculum hastatum* (Reuss, 1850), *Parakrithe dactylomorpha* Ruggieri, 1962, *Cnestocythere lamelicosta* Triebel, 1950, *Krithe* sp. 1, *Loxoconcha punctatella* (Reuss, 1850) and *Henryhowella asperrima* (Reuss, 1850) comprises 43% of all individuals represented by both adults and juveniles. The infra- to circalittoral species *Pterygocythereis calcarata* (Bosquet, 1852) is supposed a "kymatophob", avoiding wave action (Wellenbewegung) (Liebau, 1980). The presence of its exceptionally well preserved and abundant adult valves indicates a position below wave base and/or low water motion.

The marine ostracod assemblages of the Czech Carpathian Foredeep contain a relatively high number of circalittoral/epibathyal to shallow infralittoral species, in contrast to the shallow water and phytal ostracods of the Polish Carpathian Foredeep.

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British Upper Silurian Myodocopes: a new stratigraphical tool for regional and interregional correlation

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The Long Mountain syncline and adjacent regions in Wales and the Welsh borderland, UK, consitute probably the richest area in the world for Silurian myodocope ostracods. From this region, we document 20 species, many of them new, from over 160 localities. The myodocopes occur infrequently scattered throughout the laminated muddy siltstones, from the Trewern Brook Formation (lowermost Homerian, Wenlock Series) to the Cefn Einion Formation (uppermost Ludfordian, Ludlow Series).

Fine biostratigraphic control provided by graptolites (<1Ma) in the Long Mountain sequence facilitates the development, for the first time, of a biozonation for the upper Silurian based on myodocopid ostracod faunas, which can also also be coupled with chitinozoan biozones. The preliminary results presented here focus on seven regions of Wales and the Welsh Borderland. Six myodocope biozones are identified, ranging from the late Homerian (Wenlock Series) to uppermost Ludfordian (Ludlow Series). The biozones are provisionally named as '*Entomozoe*' *depressa* (key species has its first occurrence in the late Wenlock *ludensis* graptolite biozone), *Parabolbozoe bohemica* (key species has its first occurrence in the early Ludlow *nilssoni* graptolite biozone), *Silurocypridina retroreticulata* (key species has its first occurrence in the *scanicus* graptolite biozone), *Parabolbozoe armoricana* (key species has its first occurrence in the *incipiens* graptolite biozone), *Richteria migrans* (key species has its first occurrence in the *leintwardinensis* graptolite biozone) and *Bolbozoe acuta* (key species has its first occurrence in the *Bohemograptus* proliferation interval). The new biozonation allows enhanced interregional correlation within the UK and also allows correlations with various Silurian horisons in Western and Eastern Europe, Arctic Russia and Central Asia. Myodocopes have the potential to provide biostratigraphic control as precise as that of graptolites during the late Wenlock and Ludlow, and are useful proxies for key graptolite biozones even where graptolites may be absent. The myodocope faunas from the Silurian of Britain will be published in a forthcoming monograph of the *Palaeontographical Socety*.

A Silurian pentastomid parasitic on ostracods

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Pentastomids (tongue worms) are worm-like arthropods known today from ~140 species. All but four are parasitic on vertebrates. Their life cycle typically involves larval development in an intermediate host followed by maturation in the respiratory tract of a definitive terrestrial host. Fossil pentastomids are exceedingly rare, and known only from isolated juveniles. The possible host of fossil pentastomids and the origin of their lifestyle have generated much debate.

A new exceptionally preserved species, based on adults from the mid-Silurian marine Herefordshire Lagerstätte (about 425 million years BP), is the only known fossil pentastomid associated with a host, in this case a species of ostracod crustacean. The pentastomids are preserved near eggs within the ostracod and also, uniquely for any fossil or living pentastomid, attached externally to the host. This discovery affirms the origin of pentastomids as ectoparasitic on marine invertebrates. The terrestrialization of pentastomids may have occurred in parallel with the vertebrate invasion of land.

The landscape of a bronze age riparian community at Wittlesey Cambridgshire, UK microfaunal applications

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The Fenland of eastern England covers areas of Lincolnshire, Cambridgeshire, north Norfolk and parts of Suffolk, and comprises the largest area of Holocene deposits (c. 4000 km^2) in Britain. Mid- to Late Holocene Fenland muds and silts accumulated as salt marshes, crossed by a system of tidal creeks that now form dendritic silt ridges known as 'roddons' (Smith et al., 2010, 2012). Tidal marine conditions dominated the study area near Whittlesey, to the east of Peterborough, throughout the Mid-to-Late Holocene, but by about 4000 years BP, freshwater systems were established. Here, on the bank of a freshwater channel of the 'Proto-Nene' drainage system, a Bronze Age community was established. Archaeological excavations have brought to light swords and spears, together with domestic objects such as textiles, ropes, buckets, pottery, wooden bowls, wicker baskets, knives, spoons and tools. The discovery of six boats hollowed from oak trees (one dating to c. 3,300 years B.P.), twelve eel traps, the remains of wooden walkways and fish weirs within the channel, prove the dependence of this riparian community on the river for transportation, hunting and fishing. A fire appears to have ended human activity at the site about 1800 years B.P.

Environmental conditions in the channel can be postulated from the freshwater ostracods that dominate the microfaunal assemblages. The very rare foraminifera were reworked from the roddons, into which the channel was incised, but the ostracods include common *Candona neglecta*, *C. candida*, *C. angulata*, *Limnocythere inopinata*, and less numerous *L. sanctipatricii*, *Cyclocypris ovum*, *Darwinula stevensoni*, *Cypria ophtalmica* and *Herpetocypris* cf *chevreuxi*. Using environmental data given by Meisch (2000), it is possible to suggest that during the Bronze Age, channel conditions were essentially oligohaline, although several species were tolerant of slightly higher salinities (i.e. generally less than about 2 psu, but possibly up to ±5 psu at times). Waters appear to have been cool with oligothermophilic species forming a significant proportion of the community, although rare mesothermophilic and polythermophilic taxa indicate temperatures were not extreme. The stratigraphically highest sample may have accumulated in slightly elevated water temperatures, moderately flowing water and with salinities similar to those of the lower part of the succession. The calcium content is difficult to estimate, but levels of 18-72+ mg Ca/l may be postulated.

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Redefinition of the Genus *Caspiocypris* Mandelstam, 1956 (Ostracoda, Candoninae) and its distribution in the Neogene and Quaternary of Italy

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Genus *Caspiocypris* (Ostracoda, Candoninae) was established by Mandelstam in 1956 with type species *Bairdia candida* Livental, 1929. As underlined by the author, its main diagnostic character is its adont hinge in which an evident and strong ledge is present below the groove of the left valve. In lateral view, the shell shape is rather variable, with a sub-trapezoidal to high trapezoidal shape and cardinal angles more or less pronounced.

Except for the eastern Paratethyan literature in which the genus *Caspiocypris* has been generally correctly recognized, some misidentifications have occurred. In our opinion genera *Labiatocandona* Krstić & Stancheva, 1990, *Reticulocandona* Krstić, 1972 and *Bononiella* Stancheva, 1984 are junior synonyms of *Caspiocypris*, while some species referred to genera *Thaminocypris*, *Lineocypris* and *Candona* must to be ascribed to *Caspiocypris* as well. If such a taxonomical harmonization is correct, the genus *Caspiocypris* appears to be widespread in the Paratethyan and Paleomediterranean domains during the Neogene and Quaternary.

The most ancient occurrence of *Caspiocypris* is recorded in the upper Sarmatian of Hungary and northeastern Turkey. From then on, *Caspiocypris* is mainly recovered in the Paratethys domain with more than thirty species, some of which occur over a large time-span in a wide geographic area, such as *Caspiocypris labiata*, *Caspiocypris alta* and *Caspiocypris pontica*. These three "cosmopolitan" species have been recovered also outside the Paratethyan realm, in the Palaeomediterranean. In particular, *C. labiata* has been recovered in the Tortonian to lower Messinian brackish deposits of the Valdelsa and Volterra basins (Tuscany, central Italy) whereas *C. alta* and *C. pontica* have been recorded in the post-evaporitic Messinian lago-mare deposits of Spain and Italy.

The genus *Caspiocypris* has been identified also in Plio-Pleistocene deposits of Italy, with species whose geographic distribution is, so far, limited to their type localities. During Zanclean, *Caspiocypris sambucensis* has been recovered in the brackish waters of the Valdelsa Basin. During late Piacenzian-Gelasian, two different species flocks, made respectively by four and five different species, have been recognized in freshwater deep lacustrine environment at L'Aquila Basin (San Nicandro Lake) and Tiberino Basin (Tiberino Lake). The first species flock is characterized either by high sub-trapezoidal forms and sub-trapezoidal slightly elongated forms [similarly to some *Caspiocypris* assemblages reported from the Turiec Basin (late Miocene of Slovakia)]. The five *Caspiocypris* species recovered from the Tiberino Lake are more slender and some of them are slightly pointed posteriorly. Both type of shapes (high sub-trapezoidal and elongated sub-trapezoidal pointed posteriorly) point to adaptations to stable deep environments.

In both lakes, the ostracod biodiversity is very poor and only candonids and limnocytherids occur, as it happens in relatively younger ancient lakes. It's likely that the San Nicandro and Tiberino lakes represent two fossil examples of an "ancient lake" where rapid speciation occurred, giving rise to the endemic *Caspiocypris* species flocks, followed by a long-term stasis.

Ecology of living Ostracoda from travertine springs and lakes of Western Carpathians

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Travertine springs, lakes and their surroundings (*sensu* Pentecost, 2005) of different physical characteristics and chemical composition were sampled for living ostracodes every 4 weeks, during the period of one year, from March 2013 to February 2014. Furthermore, physical (water temperature, pH, ORP, EC) and chemical (alkalinity, acidity, DO, SO_4^{2-}, Cl^-, Fe, H_2S) parameters of the host were measured. Extensive survey of 28 sampling sites was performed on ten localities, including five biotopes, defined as springs, lakes, marsh, CTD (canals, cascades, terraces, and dams), and streams.

Among 26 ostracode species from the sediment surface samples, *Heterocypris incongruens, Cypridopsis vidua, Pseudocandona albicans, Cryptocandona vavrai, Cyclocypris ovum*, and *Psychrodromus fontinalis* were the most abundant. Three species represented by juveniles were left in open nomenclature. In addition, finding of two darwinulids *Vestalenula danielopoli* and *Microdarwinula zimmeri* was recorded.

We used Canonical Correspondence Analysis (CCA) to established relation between environmental variables and ostracode taxa. The results showed that ostracode assemblages were significantly influences by biotopes, localities and physical and chemical parameters. The main factors affecting an ostracode presence and differences between localities and habitats are ORP, oxygen content, and pH on one hand and the content SO_4^{2-}, EC, alkalinity, acidity and H_2S on the other hand.

The travertine streams and springs with high DO average (88 %, 9.3 mg/l) have the lowest variability of the measured parameters. These waters were colonized by *Scottia pseudobrowniana, Cavernocypris subteranea, Eucypris pigra, Psychrodromus fontinalis*. The sulphate springs and lakes with high EC, acidity and alkalinity are inhabited all year by monospecific population of *Heterocypris incongruens*. pH neutral to low alkaline lakes show low species diversity and occurrences of *Candona candida* throughout the year. The marshes with tuffa sedimentation are highly variable in all measured parameters. These are chemically similar to sulphate springs or lakes in their neighbourhood and populated by *Heterocypris incongruens* and *H. salina*. Or these marshes are significantly different in alkalinity, acidity, ORP, DO, EC and species composition (*Pseudocandona albicans, Cryptocandona vavrai*) from the nearest source of the travertine water.

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Mating behaviour and male upper lip morphology of the genus *Parapolycope* (Cladocopina): its significance for speciation

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Species of the suborder Cladocopina are all benthic from not only intertidal zones to the deep sea, but also in cryptic habitats such as anchialine caves and interstitial environments. This study reports on observations of the mating behaviour of the interstitial genus *Parapolycope*. From the coast along southwest Japan, nineteen *Parapolycope* species including ten undescribed species were found, representing the highest species number compared with other genera of Polycopidae. All parapolycopid species exhibit a small body size, a lack of photoreceptive organ, and sexual dimorphic characters in the antennula, antenna and upper lip. During the mating behaviour of *Parapolycope spiralis* Tanaka and Tsukagoshi, 2010, the male follows the stages: (1) capturing the female by suckers on the antennula, (2) clasping and maintaining the endopodite claw on the antenna, (3) making contact by the distal part of the upper lip, (4) copulating, and (5) inserting his uropodal projection into the female genital opening to make the mating plug.

Particularly, this study discusses the functions of the morphologically diversified male upper lip of parapolycopid species from the viewpoint of the sexual selection theories. The male upper lip shows species-specific and largely diverged morphologies. It is suggested that the specific contact stimuli might be caused by various shapes of male upper lip and that females discriminate a favorable mating partner depending on these stimulations. The molecular phylogenetic analyses based on nuclear 18S and ITS sequences proved that the morphological evolution of the male upper lip occurred in the early stage of speciation.

Seasonal distribution and species succession of Ostracoda in Taşlıyayla-Seben reservoir (Bolu,Turkey)

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In order to understand the relationship between seasonal distribution of ostracods and environmental factors, monthly samples (August 2013-September 2014) were collected from 15 stations around Taşlıyayla reservoir along with 12 different environmental factors. A total of 19 taxa (8 living) belonging to 12 genera were determined. All the taxa are new records for the study area. According to the Ostracod Watch Model (OWM), three species (*Cypridopsis vidua*, *Potamocypris variegata*, *Limnocythere inopinata*) occurred most frequently during fall season while *C. vidua* was also seen in summer season. Thus, stenochronal occurrence of these species seems to be limited to five months within two seasons. The finding of relatively low numbers of species in these seasons may be related to the development time of the reservoir. Since the water deposition has been processed for the last 8 years, this period of time may not be enough for species succession. During the study, water temperature, electrical conductivity and pH values were increased when dissolved oxygen was reduced. This corresponds with a significant reduction in wind speed and an increase in air humidity. Besides, the differences between the mean values of water and air temperature were significant ($p<0.001$), supporting strong evidence of the effect of air temperature on the water body. The lower and upper values of water temperature (1.8 to 19.9°C), electrical conductivity (37.9-175.2), pH (4.46 -8.73) and dissolved oxygen (2.9-20.49 mg/L) were measured *in situ* for winter and spring seasons. In contrast, species were common in October and November when the water temperature (9.6 and 21°C), salinity (0.04-0.07), electrical conductivity (80.9-127.4), pH (7.5-9.4) and dissolved oxygen (6.44-13.04) values were ranged. There may be a couple of reasons (a/biotic) for species disappearance but our work is limited to include all of them. Nevertheless, results imply that rather than the abiotic factors (e.g., water temperature, salinity, EC, pH and dissolved oxygen), the species seasonality may be the best explanation for the species occurrence.

Response of ostracods of the Baltoscandian Palaeobasin to the Hirnantian glaciation

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The Upper Ordovician rich and diverse ostracod fauna in Baltic Palaeobasin is dominated by palaeocopes, metacopes and binodicopes. Palaeocopes and metacopes tend to dominate strongly over binodicopes in inner shelf zone, towards outer shelf this dominance somewhat decreases (Meidla, 1996a).

The Upper Ordovician Hirnantian glaciation brought along some severe changes in Baltoscandian ostracod faunas. At the beginning of glaciation the majority of pre-Hirnantian warm-water ostracod species disappeared and a new cold-water ostracod association appeared. The so-called *Harpabollia harparum* association comprises mostly of binodicopes, by far the most dominant species being *Harpabollia harparum* (Troedsson), *Circulinella gailitae* Meidla, *Aechmina groenwalli* (Troedsson) and *Rectella sturiensis* (Gailite) (Meidla, 2007). Analogous associations have been found to replace pre-Hirnantian warm-water ostracod associations in Hirnantian strata of many different locations of Baltic Palaeobasin.

There are some areas where ostracod associations are different. In Råssnäsudden section (southern Sweden) the typical Hirnantian ostracod fauna is missing due to sedimentational gap, but some ostracod species range from pre-Hirnantian into the basal Silurian, so the faunal change seems to be somewhat less severe there (Truuver *et al*., 2012). North Estonian long-ranging, endemic *Medianella aequa* ostracod association, comprising mostly podocopes disappears rather shortly after the onset of glaciation (Meidla, 1996b). In polish Ketrzyn IG-1 drillcore ostracod material, some species, that in most Baltoscandian areas occur in pre-Hirnantian strata and disappear at the beginning of Hirnantian, appear among the typical *H. harparum* association species. Binodicopes are still dominating as in north-easterly areas, but eridostracans form almost a quarter of the total amount of species. This kind of species mixture is not known in other parts of the Baltoscandian region.

Though Hirnantian glaciation had a very strong impact on ostracod associations, there were some areas of refuge, where more resilient warm-water ostracod species managed to survive for some time at the beginning of the climatic catastrophe. These areas were most likely located in outer shelf zone where the temperature drop and sea-level drop induced by glacier formation in the Gondwana supercontinent were less remarkable.

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Distribution of ostracod assemblages in Çiğdem and Terzili Ponds, Kastamonu, Northern Turkey

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Çiğdem and Terzili Ponds are located in the southeastern and northwestern parts respectively of Devrekani town, Kastamonu. Comparison of mean annual precipitation rates in the last 35 years for the city of Kastamonu has shown that the lowest precipitation was realised in 2007 and arid conditions prevailed. Also, Landsat 4-5 TM images, taken between 22th May 2007-11th September 2007, display dramatic shoreline retreats in the ponds. After the retreats, eighteen samples were collected along the littoral zones of the ponds in September 2007.

Seven genera and eight species-level taxa of ostracods belonging to four families have been determined: *Ilyocypris bradyi, Ilyocypris salebrosa, Trajancypris* cf. *clavata*, *Potamocypris zschokkei*, *Limnocythere inopinata*, *Candona* sp., *Herpetocypris* sp. and *Cypridopsis* sp.

Ostracods, *Radix ovata* from gastropods and Charophyta gyrogonites obtained in the study are common in freshwater salinities (<‰ 0,5) with shallow, temporary, small and stagnant conditions. Also the species have widespread geographical distribution in the faunal area. *Trajancypris clavata* and *Potamocypris zschokkei* are only observed in Palearctic ecozone, whereas *Ilyocypris bradyi*, *Ilyocypris salebrosa* and *Limnocythere inopinata* are recorded throughout the whole Holarctic (Karanovic, 2012). Also the first *Ilyocypris salebrosa* record in Anatolia is reported within this study.

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Paleoenvironmental interpretations and age constraints on Akkaşdağı Formation using ostracods and palynofloras, Çankırı-Çorum Basin, Central Anatolia

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The study area is located at the southern part of the Çankırı-Çorum Basin, filled by a thick Paleogene-Quaternary sedimentary sequence. The Çankırı-Çorum Basin is one of the most important Cenozoic basin of Central Anatolia. The Akkaşdağı formation, located in the southern part of the basin, unconformably overlies the basement rocks and, in turn, is unconformably overlain by Quaternary alluvial deposits. It is mainly composed of massive mudstones, laminated claystone, gravelly sandstones, bedded limestones, gypsum rose and tuffs. Nine samples have been collected for ostracod analysis. Nine ostracod taxa belonging to eight genera have been determined: *Candona* cf. *C. devexa*, *Candona* sp., *Ilyocypris bradyi*, *Cypris pubera*, *Herpetocypris* cf. *H. chevreuxi*, *Heterocypris salina*, *Potamocypris zschokkei*, *Zonocypris membranae* and *Cyprideis sublittoralis*. One hundred and eighteen samples have also been collected for palynofloral analysis. Coal bearing sediments in Kırıkkale and its vicinity (Central Turkey) yielded palynofloras of the Late Miocene and Early Pliocene age. The Late Miocene palynoflora is characterized by low diversity and abundance of spores and pollens. The Early Pliocene palynoflora, on the contrary, is rather different for the presence of rich and various palynomorphs. Spore and pollen distribution of the Early Pliocene consists of abundant herbaceous and shrubs elements. The paleovegetation underwent significant changes from the Late Miocene to Early Pliocene probably due to changes in temperature and precipitation. Chronostratigraphic ranges of the known ostracod species obtained in this study indicates Late Miocene. The mammalian fauna representing MN12 zone and the radiometric ages gathered from tuffs (7,1 ± 0,1 Ma) in previous studies also point to a Late Miocene age (Messinian). Moreover, identified palynofloras indicate Late Miocene (Messinian) and Early Pliocene (Zanclean). By combining all these data, the age of the formation is suggested as Late Miocene–Early Pliocene. *Candona* cf. *C. devexa*, *Ilyocypris bradyi*, *Cypris pubera*, *Herpetocypris* cf. *H. chevreuxi, and Potamocypris zschokkei* were mainly recovered from the lower part of the formation and point to shallow, stagnant and/or slow flowing freshwater to oligohaline water environments. On the other hand, some species (*Heterocypris salina*, *Zonocypris membranae*, *Cyprideis sublittoralis*), mainly observed in upper parts, are known as halophilic that can tolerate mesohaline salinity ranges. *Cyprideis sublittoralis* is dominant in the uppermost part of the formation and according to its population structure (juvenile/adult and valve/carapace ratios), it can be suggested that low energy conditions prevailed along the deposition of the uppermost part of the succession.

Distribution of ostracod and diatom assemblages in Beyler Dam Pond, Kastamonu, Northern Turkey

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The study area, Beyler Dam Pond, is located nine kilometres northwest of Devrekani town of Kastamonu. It covers 2.40 km^2 aquatic surface area. 21 samples were collected from the littoral zone of the pond in September 2014 when shoreline retreat prevailed to reveal ostracod and diatom assemblages with other faunal and floral data.

Six genera and seven taxa of ostracods belonging to four families have been determined: *Physocypria kraepelini*, *Ilyocypris bradyi*, *Ilyocypris salebrosa*, *Isocypris beauchampi*, *Cypridopsis vidua*, *Limnocythere inopinata* and *Trajancypris* sp.. Moreover, 78 diatom species have been detected from same sampling points. *Navicula* sp., *Cyclotella ocellata*, *Amphora ovalis*, *Gomphonema angustatum* and *Cymbella amphicephala* are abundant in diatom assemblages and especially pennat diatoms are common. Also some other studies are in progress on palynomorphs, gastropods and fish teeth.

Obtained ostracod assemblages have widespread geographical distribution. *Physocypria kraepelini*, *Ilyocypris salebrosa*, *Isocypris beauchampi* and genus *Trajancypris* are common in Palearctic ecozone. *Ilyocypris bradyi* and *Limnocythere inopinata* are recorded throughout the whole Holarctic while *Cypridopsis vidua* has a cosmopolitan distribution (Karanovic, 2012).

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Preliminary results on ostracod and diatom assemblages of Lake Eğirdir, Isparta, Western Turkey

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The Lake Eğirdir is the second largest freshwater lake of Turkey. It is located in city of Isparta and its vicinity and this area is also known as the Turkish Lakes Region. It covers 480 km^2 aquatic surface area and average water depth is about 7-8 m. Lake Eğirdir extends 50 km in N-S and 17 km in E-W directions. The narrowest part of the lake is about 1.5 km with a 1.5-2 m depth. Its height above sea level is 919 m. The origination of the lake is related to tectonic and karstic processes (İleri et al., 2014a).

In total twenty-six observation and grab sampling point locations have been realized. CTD, sechi disc, temperature, depth and pH measurements were also carried out. Lake bottom samples have been taken with 2-4 m long Livingstone cores in Hoyran (one point) and Barla-Bedre (three points) localities and an Ekman sampler at one point (İleri et al., 2014b). All of the cores showed that the bottom sediments comprise clay with occasionally silt and sandy levels and abundant microfossiliferous (ostracods, gastropods, pelecypods, Charophyta gyrogonites, diatoms, spores-pollens and fish teeth and remains) levels.

Eleven known ostracod species have been determined: *Darwinula stevensoni*, *Candona neglecta, Candona angulata, Pseudocandona* cf. *marchica*, *Physocypria kraepelini*, *Ilyocypris monstrifica*, *Ilyocypris bradyi*, *Prionocypris zenkeri*, *Herpetocypris chevreuxi*, *Isocypris beauchampi* and *Cypridopsis vidua*.

Also, twenty-seven diatom taxa have been commonly revealed from the lake. Especially, *Diatoma moniliformis* (Kützing) DM Williams was abundant in April 2013 while *Cymbella excisa* Kützing was abundant in July and October 2013. Regarding to the ecological features of the taxa, *C. excisa* is an oligosaprobious and cosmopolitan species. According to the autoecological indices, the lake has alkaline, oligo-mesosaprobic and eutrophic characteristics, while according to the diatom indices the lake was mildly polluted in April and July 2013 while moderately polluted in October 2013.

Microbiological, mineralogical, geochemical, $\delta^{18}O$-$\delta^{13}C$ and radiometric age determinations have also been performed on the sediment samples of Lake Eğirdir. The oldest sample dates back to 8557 cal BP corresponding to the Early Holocene. The average sediment accumulation rate is calculated as between 0.65-8.0 mm/year in the lake. A generalized paleoclimatic profile indicates that there were three main dry and two main wet periods during the time span. Magnetic and geochemical data also support this paleoclimatic interpretation (İleri et al., 2014a, b).

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Living and Quaternary Ostracoda from the Eastern Adriatic Sea: Biocoenoses, thanatocoenoses or palaeothanatocoenoses?

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The attribution of quite a few marine Ostracoda from the Adriatic Sea to the live-stock of to-days marine environment on the basis of empty valves has to be questioned. Especially in the Northern Adriatic Sea, at least some of the new species described by Bonaduce *et al*. (1976) seem to belong to fossil associations, i.e. palaeothanatocoenoses. In view of marine geological/sedimentological studies, which can be traced back to van Straaten (1970) and Fuetterer & Paul (1976), the type localities of these species are in regions with Quaternary, i.e. reworked Pleistocene sand and sand-mud deposits, lag deposits and strong bioturbation.

Information is given on the lagoonal to marine ostracod succession from the cores PO-1, SW of Poreć and A-18, SW of Rovinj (both offshore Istria, Croatia), which are situated in a zone of detrital dolomite-calcite sands and fine silicate sands, which according to Fuetterer & Paul show a major Eastern Alpine River (a minor Po River) provenance.

According to Breman (1976) wide areas of the North Adriatic Sea are covered with reworked Pleistocene containing high to very high (i.e. 5.000 – 20.000) ostracod valves per 100 g of sediment. During recent years, much more information on the development of the Northern Adriatic Sea during the Late Quaternary and Holocene was published mostly by Italian geologists, geophysicists, micropalaeontologists and palynologists.

Due to bioturbation most of the thanatocoenoses are intensely mixed with older palaeothanatocoenoses. Admixtures of post-glacial lagoonal components were observed far off the present coasts (see also Bonaduce *et al*., 2004).

A few studies dealt with the eastern part of the Northern Adriatic Sea; the cores PO-1 and A-18 give a differentiated picture concerning contemporaneous and older Holocene deposits. These accumulated in connection with the Late Pleistocene to Holocene sea-level rise (ca. 13-7 cal ky BP: transgressive systems tract), only in parts succeeded by thin beds of the maximum flooding surface (lag deposits, ca. 6-5 cal ky BP), and the Late Holocene highstand systems tract.

In this respect, the inclusion of 38 new species in the Recent biotas of the Adriatic Sea in zoological databases, like "World Register of Marine Species" (WoRMS) and the "World Ostracoda Database", should be considered with caution (taxa should be marked as Quaternary**)**.

Ostracod carapaces containing soft parts (biocoenoses and seasonal variations of the more common species) have been investigated by Uffenorde (1972, 1975) in the ria of the Limski kanal/LIM canal, Istrian Coast, Croatia.

Without questioning the undoubted merits and the importance of biofacial or "assemblage" analyses and taxonomical investigations in the areas of the Mediterranean Sea and its coasts (summarized for the Eastern Adriatic Sea by Sokać & Hajek-Tadesse, 1996 and for the regions around Italy by Pugliese *et al*., 2013), it is considered that knowledge of genuine ostracod biocoenoses in marine as well as coastal habitats is of far more importance not only for the accuracy of zoological databases of marine and brackish-water biodiversity but also especially concerning the urgent problems caused by environmental pollution and climatic change.

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The Anthropocene: Ostracods meet Man

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The impact of human activity on the biosphere has been used to suggest that the Holocene Epoch has ended and a new geological interval, the Anthropocene, has begun. This was inferred by Stoppani as long ago as 1873, at the height of the Industrial Revolution, when he coined the term 'Anthropozoic Era'. More recently, Crutzen (2002) postulated that the new geological epoch could be defined by global environmental change caused by anthropogenic activity, which was termed 'Anthropocene'. The concept of the Anthropocene is gathering favour within the scientific community, although it has not been formally proposed, defined or assigned a rank (although the *-cene* suffix implies an epoch). There is considerable debate as to when it began; Crutzen considered that it commenced sometime in the last 200 years, but other authors have variably suggested a start date of 10,000 years B.P. based on the development of agriculture (e.g. Smith & Zeder, 2013); *c.* 1940-1945 A.D. with the globalisation of industrial degradation (e.g. Wilkinson et al., 2014); or 16th July 1945 when the the first nuclear bomb was detonated (Zalasiewicz *et al.*, 2014).

Geological chronostratigraphical boundaries are generally recognised by biotic events preserved in the fossil record. If this is the case for the Anthropocene then palaeontological changes ought to be recognisable. However, traditional biostratigraphical methods based on speciation cannot be used; evolution has been too slow over the last 10,000 years. Extinctions, however, have been recognised in a number of biotic groups and in the recent past these have, for the most part, been related to the environmental perturbations resulting from human activity. However, in the case of ostracods, none is known to have become globally extinct during the last thousand years, with the possible exception of a few species endemic to individual lakes.

Anthropogenically induced change can be recognised in the microfossil record by means of local extinctions, pollution-related deformation and assemblage variability, industrially and agriculturally induced stress and eutrophication, as well as the introduction of exotic species. Using these threads of evidence, local, isolated, examples of anthropogenic change can be recognized in microfossil assemblages as far back as 5000 years BP. More widespread anthropogenic change in Europe and America took place particularly in the nineteenth and twentieth centuries, but profound and global microbiotic change began only in the mid twentieth century. Within the ostracod community, anthropogenic change is most profound along the coastal strip and within freshwater palaeoenvironments. However, despite the fact that ostracods possess great potential as indicators of human activity and environmental degradation, accurately dated records are limited.

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Temperature impacts on deep-sea biodiversity

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Temperature is considered to be a fundamental factor controlling biodiversity in marine ecosystems, but precisely what role temperature plays in modulating diversity is still not clear. The deep ocean, lacking light and in situ photosynthetic primary production, is an ideal model system to test the effects of temperature changes on biodiversity. Here we synthesize current knowledge on temperature–diversity relationships in the deep sea. Our results from both present and past deep-sea assemblages (including Ostracoda and other taxonomic groups) suggest that, when a wide range of deep-sea bottom-water temperatures is considered, a unimodal relationship exists between temperature and diversity (that may be right skewed). It is possible that temperature is important only when at relatively high and low levels but does not play a major role in the intermediate temperature range. Possible mechanisms explaining the temperature–biodiversity relationship include the physiological-tolerance hypothesis, the metabolic hypothesis, island biogeography theory, or some combination of these. The possible unimodal relationship discussed here may allow us to identify tipping points at which on-going global change and deep-water warming may increase or decrease deep-sea biodiversity. Predicted changes in deep-sea temperatures due to human-induced climate change may have more adverse consequences than expected considering the sensitivity of deep-sea ecosystems to temperature changes.

Taxonomy of deep-sea trachyleberidid, thaerocytherid, and hemicytherid genera (Ostracoda)

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We conducted a comprehensive systematic revision of deep-sea Trachyleberididae, Thaerocytheridae, and Hemicytheridae (Ostracoda, Crustacea) covering almost all Cenozoic genera using high-resolution scanning electron microscopy. Trachyleberididae, our main focus, is one of the most diverse and abundant ostracod families, but its genus-level taxonomy is still confusing. Approximately 700 specimens from 177 species from 47 genera were examined. The studied samples range in age from the Cretaceous to the present day and cover all major oceans in the world including Atlantic, Pacific, Indian, and Southern Oceans, Mediterranean Sea, and Gulf of Mexico. Five new genera and 45 new species are described. Emended concepts are proposed for several important genera to better stabilize their taxonomy. This study considerably reduces taxonomic uncertainty of this important component of the modern and fossil deep-sea ostracod community and provides a robust taxonomic baseline for deep-sea ostracod-based paleoceanographic, paleoecological, and macroevolutionary research.

Comparison of the hemipenis of the genus Heterocypris: a case study for *Heterocypris incongruens* (Ramdohr, 1808)

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The genus Heterocypris currently includes about 68 extant species (Martens et al., 2013). While 38 species have males, no males have been reported for 26 species and there is no clear information about whether males are present for the four species left. Among the species of the genus, *Heterocypris incongruens* has a cosmopolitan distribution but the males of the species have only been reported in Palearctic and Nearctic regions. In the course of an extensive field sampling, a total of 6 males and 59 females were collected from Haydolar pond (a man-made pond) in Pazarcık, Kahramanmaraş (Turkey). During the present study, we focused on the description of the hemipenis and compared it with others in the genus whenever possible. The length of the hemipenis (0.23 mm; N=2) was about 19% of the length of the carapace (L: 1.21 mm) in our samples. This fits to the range of the length (0.16 and 0.27%) for seven other species of the genus (this study). Several other dis/similarities were also observed within and between the species of the genus. Distal and proximal shields of the hemipenis show variability (based on the 6 different drawings (one from the current study and 5 from the literature) and SEM photos) within the individuals of male *H. incongruens* whilst no such variation is recorded for some of the species (among 35 species) of the genus in literature (e.g., *H. punctata* and *H. putei*). It is especially true for the shape of the distal shield that looks like a human-foot with a prominent heel like structure. However, most of the poor drawings in the literature for the males belonging to 35 species show variation in this part. Additionally, sexual dimorphism exists in males and females of *H. incongruens*. For example, G1 claws are similar in both sexes. However, G2 claw on the second antennae (A2) is smaller in females than males. Also, G3 claw reaching to the tips of G1 and Gm in female extends about 1.5 x and 2 x of the length of terminal segment of A2 in male and female, respectively. As a result, our study suggests that a great attention should be devoted on the description of the hemipenis when it is used as a taxonomic character in the taxonomic keys.

Reference: MARTENS K., SAVATENALİNTON S., SCHÖN I. *et al*. 2013. World checklist of freshwater Ostracoda species. World Wide Web electronic publication. Available online at http://fada.biodiversity.be/group/show/18.

On the relationship between the occurrence of ostracod species and elevation in Sakarya region, Turkey

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In order to determine the distribution of ostracods between sea level and 1133m in the Sakarya region of Turkey, 83 different aquatic sites were randomly sampled during 9-12 May, 2014. This sampling yielded a total of 9598 individuals belonging to 33 taxa (31 living). The species *Vestalenula cuneata* and *Kovalevskiella phreaticola* are documented from Turkey for the first time and *V. cuneata* is recorded for the first time from the whole Palearctic region. The number of species tends to decrease with increasing elevation while there is an increase in the number of species per site. According to the Kolmogorov-Smirnov (K-S) and Shapiro-Wilk normality tests, 'number of species' is not normally distributed but the ratio (numbers of species per site) at these ranges shows normal distribution. Thus, the hypothesis "the numbers of species per site are uniformly distributed from sea level to an elevation of 1133m." was accepted after testing with δ-corrected K-S Goodness of Fit test ($P>0.05$). The number of species with males (19 species) and without males (12 species) declined with increasing elevation. This corresponds to a decrease in the numbers of species with (14 species) and without (17 species) swimming setae on second antenna (A2). Testing the multi-level hypotheses as "occurrence of swimming setae on A2, presence of bisexual population with males and changes in elevation ranges are all mutually independent in the population sampled" showed that these characters are not dependent on each other ($P>0.05$). Similarly, there was no significant relationship among individual characters with others. The first two axes of Canonical Correspondence Analysis explained 74.4% of relationships between species and environmental variables but the variables used herein (electrical conductivity ($P=0.37$, $F=0.87$), water temperature ($P=0.43$, $F=0.93$), elevation ($P=0.55$, $F=0.88$), dissolved oxygen ($P=0.72$, $F=0.71$) and pH ($P=0.85$, $F=0.40$)) did not show significant effect on the 9 species used. Furthermore, two well-known cosmopolitans (*Heterocypris incongruens* and *Ilyocypris bradyi*) were observed in almost all of the elevation ranges, whereas *Psychrodromus olivaceus* showed limited occurrences in three ranges (101-200; 401-500 and 701-800m). Nevertheless, frequent occurrences of these three species may correspond to the fact that their tolerance levels to different variables were generally higher than the other species. Overall, these results support the fact that elevation does not seem to play a primary role on the presence of species with or without swimming setae in sexual or parthenogenetic populations. We opine that ostracods can be found in a variety of aquatic habitats as long as the conditions are suitable for them. Since our data does not include many other a/biotic factors in these elevation ranges, a general conclusion may not be computed at the moment. Further studies are required.

Geographical and stratigraphical distribution of the genus *Zonocypris* MÜLLER, 1898 in Turkey and in the World

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The genus *Zonocypris* was initially described from Madagascar by G.W. Müller in 1898. Since then, 18 living (Recent) species (*Z. alveolata, Z. calcarata, Z. cordata, Z. corrugata, Z. costata, Z. dadayi, Z. elegans, Z. glabra, Z. hispida, Z. inconspicua, Z. inornata, Z. laevis, Z. lata, Z. lilljeborgi, Z. peralta, Z. pilosa, Z. tuberosa,* and *Z. uniformis*) reported from Afrotropical, Neotropical and Palearctic regions. Among the species, *Z. hispida* and Z. *inconspicua* have been reported from Brazil and Turkey, respectively. In contrast, 19 species (*Z. costata, Z. digitalis, Z. elongata?, Z. eskihisarensis, Z. expansa, Z. gokceni, Z. gujarantensis, Z. jintanensis, Z. kurtulmustepeensis, Z. labyrinthicos, Z. maghrebinensis, Z. mckenziei, Z. membranae, Z. oliviformis, Z. privis, Z. rippeae, Z. spirula, Z. ulukislaensis, Z. viriensis*) and two subspecies (*Z. membranae elongata, Z. membranae quadricella*) are known from fossil deposits from the late Cretaceous (e.g., India, France, Russia, China, Brazil) to Holocene (e.g., Albania). Six of which (*Z. eskihisarensis, Z. gokceni, Z. kurtulmustepeensis, Z. membranae elongata, Z. membranae quadricella, Z. ulukislaensis*) are also known from Turkey. Among the living forms, *Z. costata* is the only species reported from core samples as sub/recent in Turkey. During the present study, we have encountered living forms of *Zonocypris* cf. *costata* from five non-marine localities in southeast Anatolia (Adıyaman, Diyarbakır, Gaziantep, Mardin) and Eastern Mediterranean (Hatay). Besides, *Zonocypris* n. sp? found from Mardin shares common characteristics in carapace structure, but shows differences in the soft body parts (e.g., G3 claw in A2). Overall, the living species reported herein seem to inhabit the waters with relatively high ranges of water temperature (15 - 30 °C), pH (6.8 - 8.4), dissolved oxygen (3.05 -18.8 mg/l), and electrical conductivity (103 - 1910 µS/cm) values at the altitudes from 336 to 991 m a.s.l. Accordingly, results suggest that the living species have high tolerance levels for different environmental variables within a limited geographical distribution in Turkey. In contrast, fossil forms are of much wider spatial distribution. Besides the lack of knowledge about the ecological and geographical information for individual species, there seems to be taxonomic difficulties in species identification. This is based on the usage of the carapace structures in taxonomic keys. Hence, we suggest a critical revision of the genus including both carapace and soft body parts that also covers fossil and living forms.

Ostracods at the Middle-Upper Permian boundary

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Late Permian (Lopingian) and Early Triassic times are characterised by major global environmental changes and events leading to the most important mass extinction of the all Phanerozoic.

In the middle of the 90's, another biological event was highlighted in the upper part of the Guadalupian (Middle Permian), at the Guadalupian-Lopingian Boundary (GLB), c. 8 My before the PTB (Permian-Triassic Boundary), suggested by an important turnover in foraminifera and particularly amongst fusulinids. During the last two decades, many other studies based on observations on different marine groups, such as corals, bryozoans, brachiopods, bivalves, calcareous algae and ammonoids but also on terrestrial plants, revealed important taxonomic modifications near the GLB. Moreover, some works present extinctions that already occurred in the Middle Capitanian, significantly below the GLB.

Data obtained in the last 20 years confirm that the GLB has been marked by a great biological crisis recorded in the last stage of Middle Permian (Capitanian).

In order to understand the potential causes of this biodiversity drop, several geological phenomena have been proposed: regression, volcanism (Emeishan flood basalt Province), methane release and climatic changes.

The PTB and GLB biodiversity drops are considered by some authors as a double-phased extinction event in the Late Palaeozoic. Others favour a gradual decrease in diversity from the Wordian (Middle Guadalupian) up to the end of the Permian (Clapham *et al.* 2009).

Ostracods are not known in the GLB interval. This Ph.D. project presents the first results on ostracod fauna at the GLB, based on the study of the Chaotian section (Sichuan Province, P.R. China) and the Penglaitan GSSP section (Guangxi Province, P.R. China). Additional data from the Ruteh section (Iran) and the Hydra section (Greece) have also been used in order to obtain palaeogeographic information.

Specific ostracod fauna of the chocolate-colored clays in North Caspian region

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The chocolate-colored clays, representing exotic sediment facies missing in both the older and younger formations of the Caspian Pleistocene, are widely distributed in the North Caspian region amongst the Early Khvalynian transgression deposits. They are frequent in pre-Khvalynian terrain depressions in the valleys of Volga, Ural and some of their tributaries.

The outcrops Raigorod, Cherniy Yar and Kopanovka, located on the right bank of the Lower Volga provided the material for this work. They cover Pleistocene deposits coming out on the surface, with a very complex structure typical for a large valley sporadically flooded by the sea. In Raigorod and Cherniy Yar outcrops the ostracod fauna of chocolate-colored clays is represented by the species typical for Khvalynian deposits: *Caspiolla* spp., *Amnicythere*? *quinquetuberculata* (Schweyer, 1949), *Euxinocythere virgata* (Schneider, 1962), *E. bacuana* (Livental, 1929), *E. relicta* (Schornikov, 1964), *E. tumulii* (Aslanova in Mandelstam et al., 1962), *Loxocaspia gibboides* (Livental in Schweyer, 1949) and others.

At the Kopanovka outcrop the fauna of chocolate-colored clays is represented by a specific ostracod assemblage. The samples contain 5 ostracod species; mollusks and foraminifers are not present. Most abundant are the representatives of genus *Galolimnocythere* (3 species), while *Rectocypris*? spp. is less numerous. The single valve of *Scordiscia dorsotuberculeata* (Negodaev, 1957) was found in deposits from Raigorod outcrop section (11040±460 ^{14}C BP) along with large amounts of Caspian ostracods. These findings indicate that in the North Caspian region, apparently, brackish lakes existed earlier. The specific fauna of those lakes has not spread into the Caspian Sea, but settled expansively in continental brackish lakes. The elements of this fauna occur at present in brackish lakes of Kazakhstan, and *Scordiscia vara* (Liepin in Liubimova et al., 1960) inhabited the Aral Sea before the ecological disaster took place there (Schornikov, 2008).

Reference: SCHORNIKOV E.I. 2008. Relic ostracods in the Lake Kushmurun fauna (Kazakhstan). *News of Paleontology and Stratigraphy*. 10-11. Geology and Geophysics. Supplement. 49. Novosibirsk: 484-488 (in Russian).

A new genus and five new species of Subfamily Cypridopsinae Kaufmann, 1900 (Crustacea: Ostracoda) from Thailand

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A new cypridopsine genus, *Siamcypridopsis* n. gen., is described here. This genus can obviously be distinguished from other cypridopsine genera by the presence of the plate-like protrusion on the postero-dorsal margin of left valve in internal view. The morphology of this plate varies in different species, for example, without tooth-like tubercle or with one or two tubercles. The position of these tubercles can be at the center or border of the plate. In the present study, five new species are described within this new genus: *Siamcypridopsis smithi* n. sp., *Siamcypridopsis renateae* n. sp., *Siamcypridopsis suttajiti* n. sp, *Siamcypridopsis khoratensis* n. sp., *Siamcypridopsis planitia* n. sp.

Two new ostracods (Crustacea: Ostracoda) from Thailand

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We describe two new species, *Dolerocypris unispinosa* n. sp. and *Hungarocypris suranareeae* n. sp., from Northern and Northeastern parts of Thailand. The main character of *Dolerocypris unispinosa* n. sp. is the presence of a spine on postero-ventral part of right valve. This feature sets it apart from other *Dolerocypris* species. *Hungarocypris suranareeae* n. sp. is the second species of this genus in Thailand and the third one in Southeast Asia. It is clearly distinguishable from other *Hungarocypris* species by the serration on both valves. *Hungarocypris suranareeae* n. sp is similar to *Hungarocypris asymmetrica* Victor & Fernando, 1981 and *Hungarocypris serrata* Chen, 1983. It can be distinguished from the former by the absence of posterior notch on left valve and from the latter by the presence of serration on postero-ventral part of left valve (it is smooth in *H. serrata*).

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