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Workshop

Methods in Ostracodology

Graz, 14th - 17th July, 2008

WORKSHOP "METHODS IN OSTRACODOLOGY"

UNI GRAZ

cPSA

Landesmuseum Joanneum
Geology and Palaeontology

Programme
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WORKSHOP "METHODS IN OSTRACODOLOGY"

Organisation

Karl-Franzens-University, Institute of Earth Sciences, Geology and Palaeontology
Austrian Academy of Sciences, Commission for the Stratigraphical & Palaeontological Research of Austria
Landesmuseum Joanneum, Department of Geology & Palaeontology

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Workshop

“Methods in Ostracodology”

Date and location

14th – 17th July, 2008

Karl-Franzens-University of Graz

Institute of Earth Sciences (Department of Geology and Palaeontology)

Heinrichstrasse 26, A-8010 Graz

Organisers

Prof. Dr. Dan L. Danielopol (c/o Austrian Academy of Sciences)

Dr. Martin Gross (Landesmuseum Joanneum)

Prof. Dr. Werner E. Piller (University of Graz)

Lecturers and demonstrators

Dr. Angel Baltanás (Universidad Autonoma de Madrid)

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With contributions of Dr. Anne-Marie Bodergat (University of Lyon), Mag. Adriana Danielopol, Dr. Christine Latal (University of Graz), Mag. Klaus Minati (University of Graz), Mag. Walter Neubauer (University of Salzburg)

Contents

Programme

Sunday, 13.07.
Arrival at Graz

Monday, 14.07.

08:00–09:00 **Registration**

09:00–09:30 **Opening**, PILLER *"Perspectives of new research trends and cooperations"*

"Geometric morphometrics"

09:30–10:20 **Lecture**, BALTANÁS & DANIELOPOL "*Overview of Geometric Morphometrics*"
Introduction to methods for landmark data

10:20–10:50 Coffee break

10:50–11:40 **Lecture**, BALTANÁS "*When landmarks are not available"*
Outline analysis (Fourier analysis, Eigenshape analysis, etc.)

11:40–12:00 Break

12:00–12:50 **Lecture**, DANIELOPOL & NEUBAUER "*Another approach to outline analysis*"
B-splines, control points and MORPHOMATICA

12:50–14:30 Lunch

14:30–15:30 **Practical session I**, BALTANÁS, DANIELOPOL & MINATI
Data acquisition for morphometric analysis, image enhancement and outline recording from photographs and line drawings

15:30–16:00 *Coffee break*

16:00–17:00 **Practical session II**, BALTANÁS, DANIELOPOL, MINATI & NEUBAUER
"*Shapes change into numbers*" – Fitting functions to outlines
"*Building morphospaces out of shape numbers*"

17:00–17:30 *Break*

17:30–18:00 **Lecture**, BALTANÁS & DANIELOPOL "*Statistics*"
Statistical tools for the analysis of morphospace data

18:00–19:00 **Practical session III**, BALTANÁS, DANIELOPOL & MINATI
Practical work with the data using software packages

19:30 Joint evening dinner

Tuesday, 15.07.

"Geometric morphometrics"
(continued)

09:00–10:30 **Practical session IV**, BALTANÁS, DANIELOPOL, MINATI & NEUBAUER
A full set of ostracod images is provided to the participants. They should perform a full morphometric analysis using various approaches (from outline recording to morphometric and statistical analysis)

10:30–11:00 *Coffee break*

11:00–12:00 **Practical session IV** (continued), BALTANÁS, DANIELOPOL, MINATI & NEUBAUER

12:00–12:50 **Final session**, DEMONSTRATORS & PARTICIPANTS
Presentation and discussion of results, problems solving, review of main topics, further applications

12:50–14.30 Lunch

"Stable isotope analysis"

14:30–16:00 **Lecture**, BOOMER "*Stable isotopes*"
Introduction to stable isotopes and mass spectrometry (IRMS) and use of carbon and oxygen isotopes from carbonates in Earth Sciences (with reference to ostracods)

16:00–16:30 Coffee break

16:30–18:30 **Practical session**, LATAL & GROSS "*Stable isotope laboratory, sample preservation and SEM*"
"*Practical work in the stable isotope laboratory*" – Introduction to the mass spectrometer Finnigan Delta Plus + automated carbonate preparation Kiel II; sample preparation and measurements of ostracod samples
"*Detection of diagenesis*" – Visualisation of diagenetic effects by using light and scanning electron microscopy

19:00 Guided sightseeing tour downtown Graz

Wednesday, 16.07.

"Lake Pannon"

09:00–09:30 **Talk**, PILLER "*From the Middle Miocene Paratethys Sea to Late Miocene Lake Pannon*"

09:30–10:00 **Talk**, GROSS "*Environmental changes reflected by ostracod faunas at Mataschen (Early Pannonian)*"

10:00–10:30 **Talk**, PILLER *"High-resolution environmental fluctuations in the Middle Pannonian at Hennersdorf"*

10:30–11:00 Coffee break

11:00–11:20 **Talk**, RAMOS *"The radiation of Cyprideis (Ostracoda) in the Miocene from Pebas/Solimões Formation"*

11:20–11:40 **Talk**, BOOMER *"New evidence for a size-salinity relationship in Cyprideis torosa"*

11:40–12:10 **Talk**, BODERGAT *"Ecophenotypic ornamentation of ostracod species and salinity of the ambient water"*

12:10–14.30 Lunch

14:30–17:00 **Field trip**, GROSS "*Clay pit Mataschen – Late Miocene Lake Pannon*"
Sedimentary environments in ancient Lake Pannon, demonstration of high-resolution sampling techniques

19:00 Welcome at the Landesmuseum Joanneum (with buffet)

Thursday, 17.07.

"Stable isotope analysis"
(continued)

09:00–09:45 **Lecture**, BOOMER "*Stable isotope case studies*"

09:45–10:30 **Talk**, LATAL "*Palaeoenvironmental reconstructions by stable isotopes from molluscs and ostracods of the Central Paratethys Sea and Lake Pannon*"

10:30–11:00 Coffee break

11:00–12:30 **Open discussion**, DEMONSTRATORS & PARTICIPANTS "*Stable isotope data and their use for palaeoenvironmental interpretation*"

12.53–14:30 Lunch

"Closure of the workshop"

14.30–17:00 **Final discussion**, DEMONSTRATORS & PARTICIPANTS "*Geometric morphometrics, sampling/sample preparation and stable isotopes*"
Discussion of demonstrated methods and data brought by participants, discussion of further research directions

Friday, 18.07.

Departure

Ecophenotypic ornamentation of ostracod species and salinity of the ambient water

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Interpretation of ecophenotypic ornamentations of ostracods carapaces in relation with the environmental parameters has given rise to several studies. A first, two parameters have been mainly considered: salinity and temperature.

Ecophenotypism is the morphological answer to the environmental parameters of species having a genetic plasticity. This answer depends on the ecological valence of the species. Ecophenotypism, in the experimental conditions, is replicative.

Salinity is theoretically defined as the total number of grams of inorganic dissolved salt ions present in 1 kg of seawater (LIBES 1992).

According to CARBONNEL (1969), SANDBERG (1964), VESPER (1975), GARBETT and MADDOCKS (1979), VAN HARTEN (2000), there is a positive correlation between thickness, ornamentation of carapaces and the rise in salinity of the ambient water. Nevertheless, GARBETT and MADDOCKS (1979), PEYPOUQUET (1977), BODERGAT (1983), DEBENAY et al. (1994) note a decrease of thickness and ornamentation of the carapaces, for the same species, in the hyperhaline environments.

Acording to CARBONNEL (1975), PEYPOUQUET (1977), HARTMAN (1982), IKEYA and UEDA (1988), high temperatures could favour the development of ornamentation.

Nutrients inputted in the environment depends on the season; they can also influence the ornamentation of carapaces (BODERGAT 1983, BODERGAT et al. 1993, CARBONEL and HOIBIAN 1988, RUIZ et al. 2006).

We examine the effects of salinity on the ornamentation of carapaces of *Cyprideis torosa*, *Leptocythere psammophila*, *Cytheromorpha acupunctata* and *Neomonocratina reticulata*.

Cyprideis torosa

Carapaces of *Cyprideis torosa* have been analyzed by means of the electronic microprobe. They have been collected in France, in Noirmoutier island, on the Atlantic littoral, on the Mediterranean littoral, in France and in Spain, near Alicante. Salinity ranges from 3g/l to 140g/l (BODERGAT 1983).

Five types of ornamentation occur among the analyzed specimens : smooth, punctuated, half-reticulated, reticulated and noded. Samples have been analyzed by means of the electronic microprobe. Results have been submitted to a Correspondence analysis (CA).

In this study, salinity is the most important parameter which influences the ornamentation of carapaces although, according to KEYSER (2005), high contents in Ca in the ambient water could explain the realization of noded carapaces. The punctuated character is ssociated with the summer season. On the other hand, this character is also associated to K-P-Mn which gives evidence of a low rate of sedimentation (COTILLON 1968); as K is linked to the clays, punctuated character could be developed on fine substrates; the half- reticulated character is associated to Si, linked to quartz and consequently could favour a coarser substrate.

Leptocythere psammophila

Samples of living *Leptocythere psammophila* have been collected (BODERGAT et al., 1993) in the littoral of Baltic sea (salinity: 16g/l), North sea (22g/l<Salinity<35g/l) and English channel, in France (35g/l< Salinity<50g/l), three times a year (spring, end of summer and winter).

Carapaces of *L. psammophila* are reticulated and show a smooth area in the antero-ventral part of the carapace; this surface area is more or less important. Punctuations are always larger and less numerous on the carapaces of the specimens of the Baltic sea (low salinity) which do not possess an anterior smooth area, or if it's present, it's insignificant. The same comparison with respect to seasons does not reveal any differences except that variability in the size of the punctuations is greater in the specimens sampled during the summer than those sampled during the spring.

Specimens have been analyzed by means of an electronic microprobe and thirteen chemical elements were detected. Results of a Normalized Principal Component Analysis does not make possible to perceive homogeneous ensembles for the stations even if the Baltic specimens are less dispersed; in return, the grouping of the samples by seasons make evident the chemical composition of the summer individuals is controlled by variation in water salinity and in terrigeneous sediment supply.

Comparison of variances shows important differences for the North sea samples and for the summer samples.

Ornamentation has relation with salinity but it is also influenced by variability of the chemical composition of the ambient water.

Cytheromorpha acupunctata

IKEYA and UEDA (1988) have monthly collected specimens of *Cytheromorpha acupunctata* in Hamanako-Bay (Pacific coast, Central Japan). In the studied station, a moderately well-sorted sandy silt constitutes the edaphic substrate but it's a little coarser in June. The dissolved oxygen and pH values are rather stable throughout the year. Temperature is higher in summer and salinity lower; rise of temperature starts a little earlier than the decrease of salinity.

In summer samples, individuals with well-developed ornamentation are more numerous than in the winter samples. In these winter samples, specimens with fine ornamentation are dominant. In autumn and spring, an intermediate type of ornamentation is observed.

Development of coarse ornamentation could be related either to higher temperature or lower salinity. In Hamanako Bay, the rise of temperature starts a little earlier than the decrease of salinity: as the adults survive after the last moulting, development of coarse ornamentation could be related to the temperature. We have to note that the granulometry of the substrate - coaser in June- is not taken into account.

Neomonoceratina microreticulata

In Mahakam Delta (Borneo Island, Indonesia), specimens of *Neomonceratina microreticulata* show different ornamentations, very faint in front of the delta mouths and coarser between the delta mouths.

We can think salinity is lower in front of the delta mouths and could favour low ornamentation. CARBONEL and HOIBIAN (1988) consider the effects of organic matter inputs from the rivers having passed through areas of dense vegetation.:

- result of consumption of organic matter by bacterias is decreasing pH;

- consequently, $CaCO_3$ is dissolved and ostracods do not have $CaCO_3$ enough to build their carapace.

In the case of *N. microreticulata*, in Mahakam Delta, inputs of organic matter in the ambient water could favour faint ornamentation as a consequence of a low pH.

Conclusion

Salinity, according to Libe's definition, expresses the chemical composition of ambient water. Most of the time, there is a relation between ornamentation of ostracods carapaces and salinity value but some other parameters have to be taken into account:

- contents in calcium of the ambient water;
- granulometry of the substrate;
- seasons which influences nature, amount and regularity of nutrients inputs in the environment;
- temperature;
- pH of the ambient water which could result, in some cases, of the consumption of organic matter by bacterias.

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The analysis and interpretation of oxygen and carbon stable-isotopes in Ostracoda

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The study of oxygen and carbon stable-isotopes are now routinely applied to environmental and geological samples of both inorganically-precipitated and biomineralised carbonate material. This analytical approach may, under the right conditions, provide an insight into past water temperatures, precipitation-evaporation pathways, hydrological sourcing and carbon cycling. Such studies, together with recent technological advances on the analytical side now mean that palaeoenvironmental proxies may be obtained from single valves of even the smallest ostracod species although larger samples are generally required for most day-to-day analyses. This presentation will cover the following main aspects:

- An introduction to stable-isotopes, the principles of mass-spectrometry and the theory behind the technique will be followed by a focus on the interpretation of oxygen and carbon stable-isotope samples, concentrating in particular on issues surrounding the Ostracoda.
- Particular reference will be made to the study and interpretation of stable-isotope data from Ostracoda, illustrating their limitations and potential in a range of settings ranging from the deep-sea to freshwater lake systems.

The theory behind oxygen and carbon isotope fractionation will be dealt with briefly followed by discussion of the hydrological and carbon cycles and their impact upon $\delta^{13}C$ and $\delta^{18}O$ records in water and carbonate and how that is represented in the ostracods. Biological fractionation within the ostracods (vital effects) will be addressed. Much of this discussion will be based on examples from freshwater systems. The problems and practicalities of dealing with ostracod samples will be addressed including important issues of contamination (and how to avoid it) and how to prepare them for analysis. This presentation will be followed by a visit to the Graz isotope laboratory courtesy of Christine Latal and we will spend time showing how the separate components of the system work.

In a follow-up session a number of examples (published and unpublished) will be used to show how stable-isotope records from ostracod calcite may be used to reconstruct past hydrological changes from a range of environments.

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New evidence for a size-salinity relationship in *Cyprideis torosa*

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Preliminary data from four sites of varying salinity (from Europe and the Aral Sea) suggests that there may be a ***negative*** relationship between carapace size and salinity within the pandemic, euryhaline species *Cyprideis torosa*. This relationship is strongest between about 0.5 ppt and 10 ppt.

It is interesting to note that the point at which the relationship 'appears' to break down (there seems to be relatively little difference in carapace size above salinities of about 10 ppt) coincides with the hydro-biochemical boundary between hyper- and hypo-osmoregulation in *C. torosa* identified by Aladin (1993).

The study also suggests that it may be possible to reconstruct, albeit semi-quantitatively, salinity variability below the 10 ppt threshold. The results also illustrate the wide range of sizes observed for adult valves collected from natural habitats and shows that size alone may not be used within this species as an indicator of instar stage.

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The radiation of *Cyprideis* (Ostracoda) in the Miocene from Pebas/Solimões Formation

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Studies in Miocene deposists of northweastern Amazonia (Peru, Colombia and Brazil) have revealed the high diversity and endemicity of the genus *Cyprideis* (PURPER 1979, MUÑOZ-TORRES et al. 2006). Eventhough the Miocene age for these Neogene deposits is well established (HOORN 1994, MUÑOZ-TORRES et al. 2006), the paleoenvironment has been debated. The use of new methodologies, as the isotopic analysis in Mollusca and ostracodes shells allowed to interpret the environmental deposition of this unit as the largest and most enduring lake system ever known (VONHOF et al. 2003, WESSELING et al. 2002). The marine influence is rare and insignificant, and occurred in a very short time (HOORN 2006). Recent studies of the ostracods from the Neogene deposits of the Solimoes Formation, in the southwestern of the Amazonia state, Brazil allowed to recognize the endemic ostracofauna and extend its geographical distribution southwards, determine the age of the studied deposits and also assist the paleoenvironmental interpretations. Although the genus *Cyprideis* is the most diverse and abundant in previous studied localities (Benjamin Constant, Atalaia do Norte, Pebas, Santa Sofia, and others), some other genera and new species have been also described southwards (RAMOS 2006a). The *Cyprideis* species were found to co-occur with one or more species of the freshwater or lacustrine genera *Cypria, Darwinula, Cytheridella, Ilyocypris* and *Heterocypris* (SHEPARD and BATE 1980, PURPER 1979, MUÑOZ-TORRES et al. 1998, RAMOS 2006a, 2006b, 2007). Additional pilot isotope analyses on *Cyprideis* carapaces (H. Vonhof, pers. comm.) have yielded very negative D18O values indicative of freshwater. *Cyprideis* radiations are also known from the Miocene Lake Pannon in Central Europe and Lake Tanganyika (East Africa), both long-lived lakes (KRSTIĆ 1990, MARTENS et al. 1994, WOUTERS and MARTENS, 1992, 1994, 2001). The nature of these faunas (endemic, highly diverse, high disparity, occurrence of species flocks) resembles those of the Pebas/Solimões Formation.

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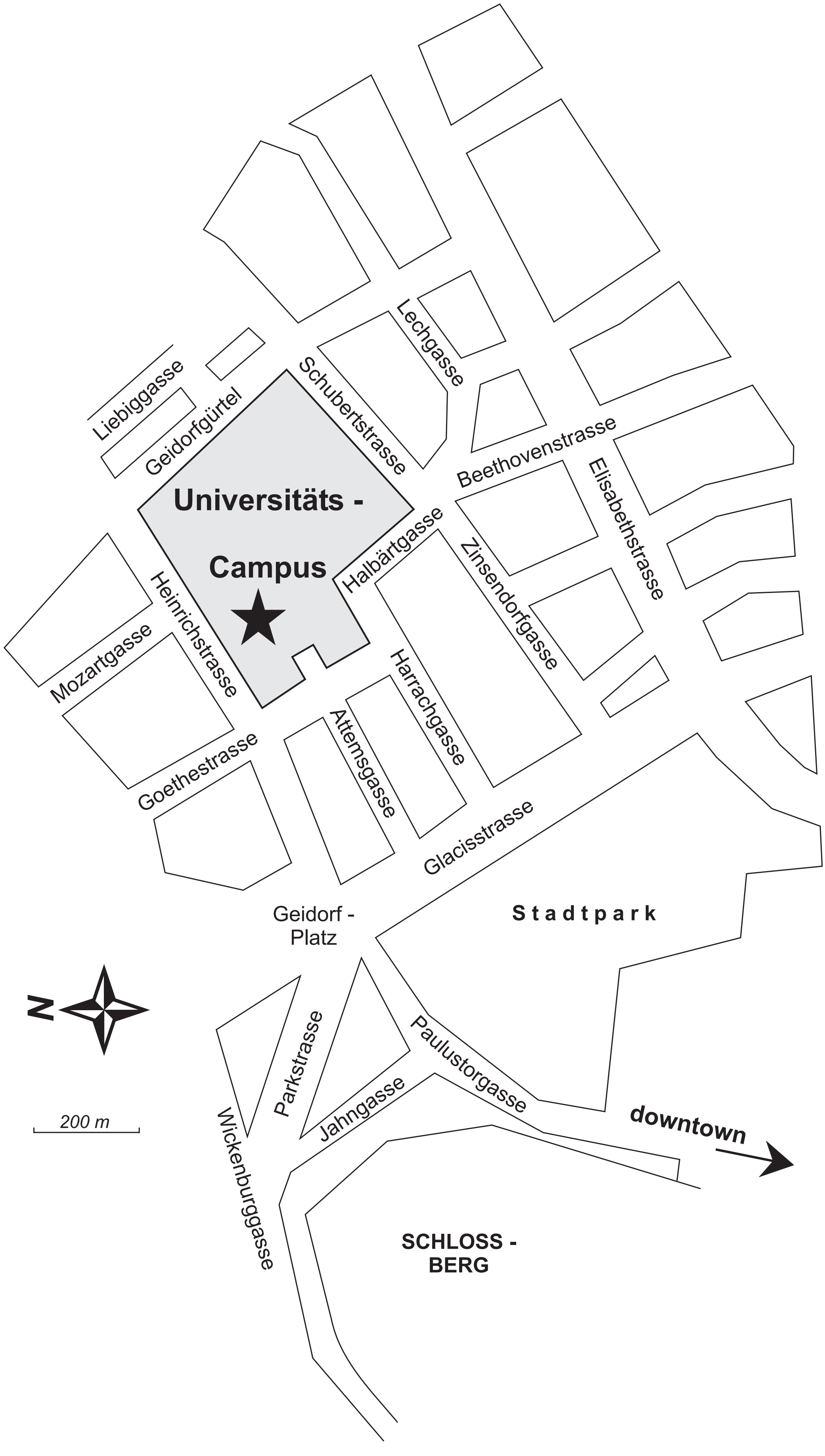
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