Symposium C – Keynote

Quaternary coral reefs as archives of environmental and climate change

Eberhard Gischler
Institut für Geowissenschaften, Goethe-Universität, Altenhöferallee 1, 60438 Frankfurt am Main, Germany

Reefs have long been used as climate indicators in earth history in that their occurrence has usually been interpreted as expression of warm climates in low latitudes and western ocean regions, in analogy to modern tropical coral reefs. This approach has been modified due to the fact that fossil reefs and reef building organisms in many cases had other ecological demands as modern corals and calcareous algae (Kiessling et al. 2002). Also, the research on modern north Atlantic coral reefs has shown that diverse reef ecosystems may also occur in deep and cold water in high latitudes (Freiwald & Roberts 2005).

Current research approaches in the Quaternary focus on skeletons and shells of reef organisms (sclerochronology) as well as reef sediment successions in order to obtain high-resolution climate proxy data that help to reconstruct sea surface temperature, salinity, precipitation and other parameters, sea-level variation, and ecological change.

The skeletons and shells of a variety of reef organisms, especially corals and mollusks, are used as high-resolution archives of historical climate variation (Hudson et al. 1976). Apart from growth characteristics such as sleletal extension rate, geochemical parameters such as isotope ratios and trace element concentrations are utilized as proxies for sea surface temperature, salinity, nutrients, insolation, pH, or precipitation and atmospheric CO2 concentration (Felis & Pätzold 2004). These records go back several hundreds to thousands of years, however, the record is by far not as complete as the dendrochronological record on land. The skeletons of slow-growing sclerosponges or annually laminated sediment in special reef environments such as deep sinkholes may also be used to extend the high-resolution climate record back to thousands of years. As impressive as these records are, all of the proxies, such as skeletal extension rates, oxygen isotope ratios, or trace element concentrations have inherent problems that are sometimes difficult to interpret.

Skeletons of acroporid corals that grow at or close to sea level are excellent gauges of former sea level. Postglacial and late Pleistocene sea-level curves have been developed, e.g., in fossil reefs of Barbados, Tahiti, and New Guinea. Likewise, mangrove peat recovered from coral reefs is also used as proxy for sea level in that it is indicative of initial inundation of a formerly terrestrial area. Problems and potential errors in these records include the bathymetric range of corals, their displacement during storms, mangrove root growth, peat erosion, and isostatic differences between regions that need to by corrected for by geophysical methods (Montaggioni & Braithwaite 2009).

Sedimentary successions in reefs and reef lagoons as seen in drill cores or outcrops offer the opportunity to quantify abundance and diversity of sediment-producing organisms such as corals, algae, mollusks, foraminifera, or echinoderms. Ecological phase shifts in corals and algae, diversity of benthic foraminifera, or peaks in echinoid abundances may be used to decipher, e.g., environmental deterioration, changes in temperature or salinity, and the spread of pathogens (Aronson 2007). Problems in these approaches are largely related to taphonomical bias, e.g., bioturbation, that can potentially destroy the sedimentary succession.

These approaches have also been used successfully in the pre-Quaternary fossil record of reefs, however, interpretations get increasingly complex the further back we go in earth history.

Kiessling, W., Flügel, E. & Golonka, J. (2002): Phanerozoic Reef Patterns. – Soc. Econ. Pal. Min. Spec. Publ. 72: 775 p.

Freiwald, A. & Roberts, J.M., eds., (2005): Cold-Water Corals and Ecosystems. – 1243 p. (Springer).

Hudson, J. H. et al. (1976): Sclerochronology: a tool for interpreting past environments. – Geology 4: 361-364.

Felis, T. & Pätzold, J. (2004): Climate reconstructions from annually banded corals. – In Shiyomi, M. (ed.) Global Environmental Change in the Ocean and on Land, p. 205-227 (Terrapub).

Montaggioni, L. F. & Braithwaite, C. J. R. (2009): Quaternary Coral Reef Systems. – Dev. Mar. Geol. 5: 532 p. (Elsevier).

Aronson, R. B., ed. (2007): Geological Approaches to Coral Reef Ecology. – Ecol. Stud. 192: 439 p. (Springer).

Symposium G – Poster

High-resolution analyses of an ostracod fauna in Late Miocene Lake Pannon (E-Styria/Austria)

Frank Gitter[1], Martin Gross[1], Werner E. Piller[2]
[1]*Department for Geology & Palaeontology, Universalmuseum Joanneum, Graz, Austria*
[2]*Institute of Earth Sciences, University of Graz, Austria*

Ancient lakes, like Late Miocene Lake Pannon, are well-known stages of rapid speciation events due to ecologically driven adaptation. Here we present palaeoenvironmental as well as biotic changes during Lake Pannon's earliest phase, based on investigations at the clay pit Mataschen (E-Styria). This ca 30 m thick, limnic-deltaic succession represents in total approximately 30 ky. Besides a high-resolution monitoring of ostracod assemblages throughout 2.5 m of the profile, we explore morphological variations within the genus *Cyprideis* (e.g., outline, hinge structure) on outcrop- as well as on mm-scale.

For a high-resolution analysis, five 50 cm long cores were taken at the basal part of the outcrop (time range ~ 2–3 ky) and investigated at 5 mm sampling intervals (= 437 samples). The ostracod fauna of this 2.5 m thick sediment column is dominated by the genera *Cyprideis*, *Loxoconcha*, *Hemicytheria* and Candonidae. These taxa represent more than 95 % of the entire ostracod fauna. In the basal part (20 cm) ostracod valves are very scarce (mean ~15 valves per sample) and *Hemicytheria* and candonids are the most frequent taxa. Throughout the next 35 cm of the profile the abundance of *Loxoconcha* increases and represents 40–70 % of the fauna. About 20 cm above the first *Loxoconcha*-peak, *Cyprideis* starts to increase slowly, indicating progressively favourable conditions for this genus. This increase peaks in maxima of over 200 *Cyprideis*

valves per sample. Thus, they represent 55–80 % of the total ostracod assemblage. Upsection, at around 1.7 m of the profile, a general decrease in ostracod abundance and a slow shift to a candonid-dominated fauna is observed.

High abundances of ostracods clearly document a transgression of brackish waters within the basal meter of the profile. This results in the drowning of the pre-existing swamp/wetland system. After a short interval (~ 50 cm) of more or less stable conditions reflecting „Lake Pannon" , an increase in fluvial influx is documented by slight variations in morphology of *Cyprideis kapfensteinensis* and highly fluctuating ostracod abundances.

This work is supported by the Austrian Science Fund (P21748-N21).

Symposium A – Vortrag/oral presentation

Faunal similarities between the Frankfurt Formation in the Mainz Basin and surrounding areas

Frank Gitter[1], Benjamin Läuchli[2], Bettina Reichenbacher[2]
[1]Department for Geology & Palaeontology, Universalmuseum Joanneum, Graz, Austria
[2]Department of Earth and Environmental Sciences, Munich

The palaeogeographic situation and directions of faunal exchange in the northern Upper Rhine Graben (including Mainz and Hanau Basin) during the early Miocene is a long discussed topic. Here we present new data on microfossil associations and isotopic data, based on a drilling core taken near the train station „Mainz Röhmisches Theater".

The results support the presence of a rather thick segment (~ 18 m) of the Frankfurt Formation (= Upper Hydrobia Beds) in the Mainz Basin, which had not been known until to date. According to the microfossil content a correlation with the subzones 8c up to 9a known from the Hanau Basin could be recognized in the studied profile. As leading layers for stratigraphic interpretation a *Granulolabium*-horizon, abundant *Moenocypris* and *Gobius* mass-occurrences were recognized. Furthermore, additional nannoplankton layers above layers + 18, + 19 and + 20 known from the Frankfurt Formation within the Hanau Basin were found. Isotopic data indicate a slightly brackish to freshwater environment with at least two incursions of brackish waters and at least one pronounced drop to freshwater conditions.

The faunal composition was compared with data from the Paratethys area. Close relations between the Paratethys and Mainz Basin are suggested on the basis of euryhaline fish taxa (*Gobius brevis* and *G.* aff. *doppleri*) due to the fact that this particular assemblage does not occur elsewhere.

This discovery contributes to a refined concept of the palaeogeographic situation during the early Miocene in Central Europe.

Symposium F – Vortrag/oral presentation

Completing a 100 years lasting puzzle of the fossil lemur skull of *Hadropithecus* (Archaeolemuridae)

Ursula Göhlich[1], Laurie Godfrey[2], Timothy Ryan[3], David Burney[4], William Jungers[5], Ramilisonina[6], Natalie Vasey[6], Gerhard Weber[8]
[1]Natural History Museum of Vienna, Austria
[2]Department of Anthropology, University of Massachusetts-Amherst, USA
[3]Department of Anthropology, Penn State University, USA
[4]National Tropical Botanical Garden, Kalaheo, USA
[5]Department of Anatomical Sciences, Stony Brook University, USA
[6]Musée d'Art et d'Archéologie, Madagascar
[7]Department of Anthropology, Portland State University, USA
[8]Department of Anthropology, University of Vienna, Austria

Hadropithecus stenognathus is a fossil archaeolemurid that inhabited Madagascar during the Holocene. The first remains of this rare extinct taxon were discovered in 1899 at the Andrahomana cave in Southern Madagascar and have been since housed in the Natural History Museum of Vienna, Austria. Among these remains is an incomplete skull of a subadult individual.

In 2003, a US-Malagasy team including D. Burney (National Tropical Botanical Garden, Hawaii) and L. Godfrey (University of Massachusetts-Amherst, USA) returned to Androhamana Cave for excavation at the type *Hadropithecus* locality and found more fossil bones of *Hadropithecus*, some of them belonging to the same subadult skeleton.

In 2007, T. Ryan and A. Walker (both Penn State University, USA) conducted a project based on computed tomography technology to virtually reconstruct the incomplete skull of *Hadropithecus* for biomechanical and anatomical analysis. In this connection they made an extraordinary virtual discovery: Two frontal portions, excavated in 2003, forming the orbital brow ridge arches, fitted exactly in the bony gaps of the Vienna *Hadropithecus* skull recovered in 1899.

Their fit was proven by CT-scans based digital images, although the frontal pieces and the „Vienna skull" had never been together in one room.

Finally in 2008, the missing orbital portions were reunified to the rest of the Vienna skull of *Hadropithecus* – the „happy end" of a 100 years lasting puzzle and a curatorial stroke of luck.

Symposium D – Poster

Die Paläoflora des Randecker Maar: Palökologie und Paläoklima

Franziska Göhringer
Staatliches Museum für Naturkunde Stuttgart, Rosenstein 1, 70191 Stuttgart, Germany

Das Randecker Maar befindet sich am Nordrand der Schwäbischen Alb im ehemaligen miozänen Vulkangebiet von Urach und Kirchheim in Baden-Württemberg. Die im Tertiär durch