Daniela SCHWARZ-WINGS, Oliver WINGS & Franziska SATTLER (Editors)

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European Association of Vertebrate Palaeontologists

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Daniela Schwarz-Wings, Oliver Wings, Franziska Sattler (eds.)

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TORTOSA, T., DOUTOUR, Y., CHEYLAN, G., TONG, H. & BUFFETAUT, E.: New Late Cretaceous dinosaur localities in Provence (southeastern France)

WEIDIG, I.: An Eocene swift (Aves: Apodiformes) from North America

WINGS, O.: New early Late Jurassic vertebrate localities near Shanshan in the Turpan Basin (NW China) – a field report

Field trip guide; July 24, 2009

The Rüdersdorf Muschelkalk Quarry (Oliver WINGS)

The Rixdorf Horizon („Rixdorfer Horizont“) of the Niederlehme sand pits near Königs Wusterhausen (Oliver WINGS, Daniela SCHWARZ-WINGS & Wolf-Dieter HEINRICH)
Meeting programme

Monday July 20, 2009 – Registration of the participants

16:30 – 20:00 Arrival of the conference participants and registration at the front desk of the Museum

17:00 – ca. 22:00 Icebreaker party in the dinosaur hall of the Museum für Naturkunde Berlin

Tuesday July 21, 2009 – Scientific presentations, poster session

09:00-09:10 Welcome address

Session 1 – Chairperson: Oliver HAMPE

09:10-09:30 GIERSCH, S., FREY, E., IFRIM, C., STINNESBECK, W. & GONZÁLEZ-GONZÁLEZ, A.: Size-range and intestinal content – hints on the palaeoecology of the fossil ichthyofauna from the Late Cretaceous locality Vallecillo (North-east Mexico)

09:30-09:50 GREGOROVA, R.: Diplodus ortwini (Sparidae, Perciformes): a new fossil record of the porgies from the North Alpine Foreland Basin (Egerian, Upper Austria)

09:50-10:10 MICKLICH, N.: The fish fauna of Grube Unterfeld (Oligocene, Rupelian; Baden Württemberg, S Germany): Updated information


10:30-11:00 Coffee Break

Session 2 – Chairperson: Norbert MICKLICH

11:00-11:20 LISTON, J.: The Development of large vertebrate suspension feeding in the Mesozoic

11:20-11:40 HOCH, E.: Non-Darwinian cetology in the Nordic sphere, a source to modern palaeocetology

11:40-12:00 RIES, C. J.: Tetrapod on thin ice: the making of Erik Jarvik's Ichthyostega (1931 – 1955)

12:00-12:20 RIES, C. J.: Flight of the imagination: the making of Gerhard Heilmann's Proavis (1913-1926)

12:20-13:45 Lunch Break

13:45-14:45 Poster session

Session 3 – Chairperson: Johannes MÜLLER


15:45-16:15 Coffee Break

Session 4 – Chairperson Jean LE LOEUFF
16:15-16:35 WINGS, O.: New early Late Jurassic vertebrate localities near Shanshan in the Turpan Basin (NW China) – a field report
16:35-16:55 MALLISON, H.: A kinetic/dynamic look at sauropod locomotion

17:30 EAVP Board Meeting

Wednesday July 22, 2009 – Scientific presentations, auction, general meeting

Session 5 – Chairperson: Oliver WINGS

09:10-09:30 BELVEDERE, M., GOZZER, L. & MIETTO, M.: Landmark analysis on tridactyl footprints: still a waste of time?
09:30-09:50 MARTY, D., MEYER, C. A., PARATTE, G., LOVIS, C. & JACQUEMET, M.: Narrow- and wide-gauge sauropod trackways with similar track morphology and trackway configuration from the Late Jurassic of NW Switzerland: Brontopodus and/or Parabrontopodus?

10:30-11:00 Coffee Break

Session 6 – Chairperson: Christian MEYER

11:00-11:20 BUFFETAUT, E.: A prosauropod dinosaur from Normandy (northwestern France) and its biostratigraphical significance
11:20-11:40 RICHTER, U. & MUROCH, A.: Isolated theropod teeth from the Kem Kem Beds (Early Cenomanian) near Taouz, Morocco
11:40-12:00 LE LOEUUFF, J. & MÉTAIS, E.: Early Cretaceous vertebrates from the Cabao Formation of NW Libya
12:00-12:20 TORTOSA, T., DUTOUR, Y., CHEYLAN, G., TONG, H. & BUFFETAUT, E.: New Late Cretaceous dinosaur localities in Provence (Southeastern France)

12:20-14:00 Lunch Break and possibility to visit the exhibitions

Session 7 – Chairperson: Eberhard FREY

14:00-14:20 ELGIN, R. A.: Modelling pterosaur flight dynamics: Initial experimental findings
14:20-14:40 PRONDVAI, E. & HONE, D.: Wing extension in pterosaurs: new models
15:00-15:20 ÖSI, A., PRONDVAI, E. & FREY, E.: New interpretation of the palate of pterosaurs

15:20-15:40 Coffee Break

15:40 Auction
16:30 General meeting – election of a new board!

Thursday July 23, 2009 – Scientific presentations, poster session, conference dinner

Session 8 – Chairperson: Robert Asher

09:30-09:50 Laaß, M., Hampe, O., Schudack, M., Kardjilov, N. & Hilger, A.: Why Lystrosaurus survived the Late Permian mass extinction
09:50-10:10 Burkhardt, C. & Frey, E.: Anatomical peculiarities in Phoca (Mammalia: Pinnipedia) and their consequences on locomotion and moving options
10:10-10:30 Schellhorn, R.: Identifying fossil habitats using ungulate long bones

10:30-11:00 Coffee Break

Session 9 – Chairperson Loïc Costeur

11:00-11:20 Asher, R.: Character evolution in southern placental mammals
11:40-12:00 Horn, S., Benecke, N., Hufthammer, A. K., Schouwenburg, C., Toskan, B. & Hofreiter, M.: Ancient DNA from Holocene beavers (Castor fiber) in Europe

12:00-13:30 Lunch Break

13:30-15:00 Poster session

15:00-15:15 Coffee Break

Session 10 – Chairperson: Attila Ösi


19:00: Conference dinner in the nearby restaurant “Olive Tree” (Mercure Hotel)

Friday July 24, 2009 – Field trip

Field trip to the marine Triassic limestone quarry of Rüdersdorf (including a visit at the local mining museum and a Landrover-tour in the quarry) and the Pleistocene “Rixdorf Horizon” vertebrate fossil deposit of Niederlehme near Berlin.

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Poster presentations

BÄRMANN, E.: A total evidence approach to Ruminant phylogeny
BISCONTI, M.: Mediterranean record of balaenopterid evolution (Mammalia, Cetacea, Mysticeti)
COMPANY, J., PEREDA-SUBERBIOLA, X. & RUIZ-OMEÑACA, J. I.: Ankylosaurian remains from the Late Cretaceous of Chera (Valencia, Spain)
COMPANY, J., SZENTESI, Z. & MAKÁDI, L.: Amphibians and lizards from the Upper Cretaceous (Late Campanian – Early Maastrichtian) Sierra Perenchiza Formation (Valencia Province, Spain)
COMPANY, J., SZENTESI, Z. & MAKÁDI, L.: Amphibians from the Latest Maastrichtian La Solana locality, Valencia Province, Spain
CRUZADO-CABALLERO, P., CANUDO, J. I. & RUIZ-OMEÑACA, J. I.: Jugal remains of hadrosaurine and lambeosaurine hadrosaurids in the Upper Maastrichtian of the Iberian Peninsula (Arén, Huesca, Spain)
ESCASO, F., ORTEGA, F., SANZ, J. L., PÉREZ GARCIA, A. & GASULLA, J. M.: New material of Rhabdodon from the upper Campanian-lower Maastrichtian of “Lo Hueco” (Cuenca, Spain)
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FISCHER, J., BUCHWITZ, M., VOIGT, S. & SCHNEIDER, J. W.: How certain is the assignment of fossil chondrichthyan egg capsule types to potential producer groups?
GASULLA, J. M., ORTEGA, F., SANZ, J. L., ESCASO, F. & PÉREZ GARCIA, A.: A spinosaurid cervical vertebra from the Morella Formation (lower Aptian) of Morella, Spain
GEBAUER, E.: Molarisation in the notosuchian crocodilian Malawisuchus and the cynodont Procynosuchus, same thing, same function?
JUNGNICKEL, S. & FREY, E.: Aspects of constructional morphology of Mustelidae and Viverridae (Carnivora)
KNOLL, F., HUGUET, D., KRIWET, J. & PÉLISSÉ, T.: Middle Jurassic vertebrate faunas from the lignites of the Causses (southern France)
LÓPEZ-ANTONAZAS, R., PELÁEZ-CAMPOMANES, P., ÁLVAREZ-SIERRA, M. Á. & GARCÍA-PAREDES, I.: New species of Hispanomys (Rodentia, Cricetodontinae) from the Upper Miocene of Batallones (Madrid, Spain)
MCGOWAN, A. J., CHIRITZ, K. L. & DYKE, G. J.: The sex ratio in Irish giant deer: bachelor parties or a series of unfortunate accidents?
MONNINGER, S. & FREY, E.: Oligocene bats from the clay pits around Frauenweiler
PARDO PÉREZ, J., FREY, E., STINNESBECK, W., SALAZAR, C., LEPPE, M.: Life and Death of the Torres del Paine Ichthyosaurs, Southern Chile
PÉREZ GARCÍA, A., ORTEGA, F. & ESCASO, F.: A small pleurosternid turtle from the Upper Jurassic of Santa Rita (Torres Vedras, Portugal): Juvenile or new form?
WEIDIG, I.: An Eocene swift (Aves: Apodiformes) from North America
Confidence has recently increased surrounding the pattern of common descent shared by living placental mammals, now understood to consist of four major clades: afrotheres, xenarthrans, laurasiatheres, and euarchontoglires. Compared to previous hypotheses this tree is remarkably stable; however, some uncertainty persists about the location of the placental root, and some relations within laurasiatheres, afrotheres, and euarchontoglires. A variety of names for sub-clades within the new placental mammal tree have been proposed, not all of which follow conventions regarding priority and stability. More importantly, the newly established phylogeny enables the formulation of novel hypotheses and testing thereof, for example regarding a possible developmental dichotomy that seems to distinguish members of southern and northern radiations of living placental mammals. Here, I present new data on the apparently increased level of vertebral atavisms and variability found among southern placental mammals (afrotheres and xenarthrans) compared to their northern relatives (laurasiatheres and euarchontoglires).
A total evidence approach to Ruminant phylogeny

Eva V. Bärmann
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Ruminants, one of the largest groups of terrestrial mammals, have been the subject of behavioral, ecological and evolutionary studies for many years. However, despite great effort of paleontologists and molecular biologists, the relationships of certain ruminant subgroups remain unresolved. Many of the distinct groups (e.g., Palaeomerycidae) are even harder to place in a phylogeny where not even the molecules for the extant species produce a sufficiently supported tree, but many controversial ones. Here, I attempt to estimate phylogeny for living as well as fossil ruminants using Bayesian and parsimony methods to analyse DNA sequence data and morphological characters simultaneously.

One of the biggest problems in using morphology is the great amount of convergence (e.g., tooth characters) in many groups of living ruminants. To address this problem, I use a hierarchical approach, where the ancestral character states for smaller monophyla are reconstructed and used as terminal taxa in the second step of analysis. This method will be demonstrated for Antilopinae, for which the reconstructed tree allows the reconstruction of their most recent common ancestor.
Oral presentation

Landmark analysis on tridactyl footprints: still a waste of time?

Matteo BELVEDERE, Luigi GOZZER & Paolo MIETTO
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Landmark analysis was rarely applied to dinosaur ichnology and generally only tentatively: Rodrigues and Santos (2002) applied this morphometric technique to sauropod tracks whereas the last trial on tridactyl dinosaur tracks dates back to 12 years ago (Rasskin-Gutman et al., 1997). The present work develops from this paper: Landmark analysis is applied to large theropod footprints referable to “megalosaurian” tracks and all coming from the Upper Jurassic Iouaridène ichnosite of the Moroccan central High-Atlas, trampled on a peculiar carbonate cemented mudstone to very fine sandstone (Belvedere, 2008).

In order to verify the reliability of the landmarks proposed by Rasskin-Gutman et al. (1997), six landmarks have been applied to 15 footprints belonging to the same trackway and thus supposed to be identical. This test showed the great variability of hypeces and so their inadequacy as landmarks; thus, in the following analyses they have not been considered, reducing the number of landmarks from six to four. Then a comparison between tracks of the same morphotype was carried out, and, highlighting the similarities between footprint of different size and preservation, pointed out the potential of this method. Therefore, a comparison between the Moroccan footprints and the world record of tracks with “megalosaurian affinities” has been made, aiming to a quantitative solution of the taxonomical problems affecting these traces. Two different groups have been separated by the analysis and roughly correspond to the assemblages divided by Lockley et al. (2000) and Thulborn (2001) in their contrasting papers. Unfortunately they also correspond to the drawings made by the two authors, thus highlighting the problem of the subjectivity of the footprint interpretation and representation.

Hence, in spite of the promising results, a systematic application of Landmark analysis to ichnology is far to come, at least, until it is carried out on outline sketches and not on objective data such as photos (perpendicular to the footprints) or, better, three-dimensional models.

References:
Mediterranean record of balaenopterid evolution (Mammalia, Cetacea, Mysticeti)

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The family Balaenopteridae includes the most successful baleen-bearing whales currently living. They are the rorqual and humpback whales assigned to the genera *Balaenoptera* and *Megaptera*. The fossil history of this family can be traced back at least to 12 million years ago (Late Miocene) thanks to a rich fossil record which has not been completely described and that is scattered all around the world. In particular, well preserved fossils have been described from Neogene deposits of California, Japan, Belgium, and Italy. The Italian fossil record of Balaenopteridae represents most if not all the Mediterranean history of this family and includes some well preserved specimens now assigned to their own taxon. Phylogenetic analyses of the Italian record have been published in the past few years resulting in the placement of two Pliocene taxa at the early branching points of the balaenopterid radiation. The Italian genera *Archaebalaenoptera* and *Protororqualus* are now considered basal stem-balaenopterids characterized by elongated and straight dentary, supraoccipital with marked transverse constriction and zygomatic process of the squamosal diverging laterally from the longitudinal axis of the skull. Other specimens include a large parabalaenopterid whale from the Late Miocene of northern Italy currently under description and some historical records still to be studied. Among them, the recognition is of some importance that the Valmontasca balaenopterid assigned to *Balaenoptera acutorostrata cuvieri* in 1970 represents a new genus whose phylogenetic relationships are not yet fully understood. In the last few years, new studies on earbone collections revealed that the balaenopterid diversity in the Mediterranean Neogene was much more complex than expected. In particular, the discovery of a Late Miocene periotic interspersed amidst the bones of the large parabalaenopterid presented above and which shows interesting similarities with the modern *Balaenoptera edeni* suggests that the origins of the modern balaenopterid species can be older than previously expected. The paleobiogeographic dimension of the balaenopterid evolution is still not completely understood; the discovery of so many new basal taxa in the Mediterranean Neogene highly suggests that the Mediterranean basin played an important role in both the origin and the evolution of Balaenopteridae.
Oral presentation

**Locomotion aspects of a chroniosuchid carapace**

Michael BUCHWITZ & Sebastian VOIGT
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Segmented carapaces are abundant protection devices in Mesozoic tetrapods, such as aetosaurs and ankylosaurs. Furthermore in some temnospondylians and the reptiliomorph group Chroniosuchia a dorsal series of osteoderms fastened to the neural spines or arches occurs – probably these plates, which can show some degree of overlapping or jointing, influence the movement of the related part of the vertebral column. Only in some members of the Chroniosuchidae, however, the osteoderms are transversally broadened, forming a segmented carapace while retaining a complex plate-to-plate articulation mechanism and a ventral process articulating with one respective neural spine. In chroniosuchids the paired peg-like processes of the posterior articulation plate, a pair of narrow anterior wings, and the posterodorsal and anteroventral outer wing articulation faces enable a three-fold dorsoventral overlap of neighbouring osteoderms. The ventral processes of adjacent osteoderms overlap laterally but also the oblique-trending anterior wings and posterior processes influence lateral motility. The degree of lateral flexibility of the chroniosuchid carapaces is constrained by the medial to lateral narrowing of the sculptured non-overlapping dorsal osteoderm area.

We document the carapace morphology of a Triassic chroniosuchid from Kyrgyzstan, whose dorsal osteoderms are roof-like or arched in axial view and marked by a high transversal width/axial length ratio, enlarged osteoderm articulation faces bearing concentric rail-like ridges and furrows, and an often considerable lateral narrowing of the dorsal sculptured area. Such a conjunction of morphological features results in an osteoderm apparatus supporting a particularly high amount of lateral flexion of the trunk in combination with some dorsiflexion. Thereby the relative movement of osteoderms is strictly guided by the systems of interlocked concentric articulation face grooves and ridges.

Following these observations we are arguing that in addition to a probable protection function the chroniosuchid carapaces channelized certain trunk movements supplementing the function of the axial skeleton. In the highly derived Kyrgyz chroniosuchid the osteoderm apparatus facilitated a high-degree body undulation reminiscent of the locomotion styles in seymouriamorphs.
Oral presentation

**A prosauropod dinosaur from Normandy (northwestern France) and its biostratigraphical significance**

**Éric Buffetaut**

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The silicified conglomerates of the northeastern Cotentin peninsula (Normandy, France), deposited in a fluvial environment, have yielded extremely few fossils, although a large reptile bone was briefly reported in 1971, but never described. Their age has therefore remained relatively uncertain. Dinosaur bones recently found by M. Bernard Sauvadet in a quarry exploiting these conglomerates at La Pernelle (Manche) include fragmentary cervical vertebrae and a portion of a large femur, which belong to a large and robust prosauropod, reminiscent of both robust specimens of *Plateosaurus engelhardti* from the Keuper of Germany and of the probable melanorosaurid *Camelotia borealis* from the Rhaetian of England.

After much discussion about their age in the 19th century, the silicified conglomerates of northeastern Cotentin are now generally referred to the Late Triassic, mainly on the basis of correlation with unconsolidated detritic sediments in the same area (the Eroudeville Formation), which themselves contain very few fossils, although a Late Triassic (Norian) palynomorph assemblage has been reported. The Eroudeville Formation is overlain by the Airel Formation, which has yielded abundant fossils, including the theropod dinosaur *Lophostropheus airelensis*, and is considered as terminal Rhaetian to basal Hettangian in age, mainly on the basis of palaeobotanical evidence.

Large and robust “prosauropods” (including plateosaurids and melanorosaurids) such as the form from La Pernelle are known from the Norian to the Early Jurassic in various parts of the world. The occurrence of such a dinosaur in the La Pernelle conglomerate indicates that this deposit cannot be older than Late Triassic. Because the Eroudeville Formation is overlain by the Airel Formation, which is close in age to the Triassic-Jurassic boundary (late Rhaetian or early Hettangian), it can be concluded that the La Pernelle conglomerates are either Norian or early Rhaetian. A Norian age is in agreement with the above-mentioned palynological data from the Eroudeville Formation.

The dinosaur from La Pernelle is the oldest known dinosaur from Normandy and one of the oldest French dinosaurs.
Anatomical peculiarities in *Phoca* (Mammalia: Pinnipedia) and their consequences on locomotion and moving options

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Pinnipedia are divided into three families: Otariidae, Odobenidae and Phocidae. Phocidae, themselves, are divided into two subfamilies: Monachinae including the genus *Monachus* plus the Phocidae of the southern hemisphere and the Phocinae including the northern hemisphere Phocidae. Eponymous for the Phocinae is *Phoca*, which is referred to here as archetype.

*Phoca* features some anatomical peculiarities in its general construction. These peculiarities concern most notably the caudal body region, especially pelvis and hind limbs. Compared with Otariidae and Odobenidae, Phocidae cannot place their hind limbs under the body. As a consequence, the hind limbs cannot be used for terrestrial locomotion. One reason for this is the musculature inserting at the dorsally directed spina ischiadica and preventing the hind limbs to touch the ground. Another reason is the talus morphology characterised by a strong caudally directed processus similar to the tuber calcanei. This processus has a sulcus for the tendon of m. flexor hallucis longus. Tension on this tendon inhibits the dorsal flexion of the pes, which thus cannot be brought perpendicular to the shank. One muscle, which is responsible for the lateral undulation of the body during swimming, is m. iliocostalis lumborum that attaches on the lateral face of the iliac blade. The insertion points of the muscles running from the caudal portion of the pelvis to knee and shank are dislocated distally compared to terrestrial carnivores. The elongated post-acetabular part of the pelvis increases the leverarm for the muscles, and thus warrant powerful adduction and abduction movements of the hind limbs while swimming. The anatomy of *Phoca* in combination with its locomotor and moving options forms the heuristic base for the reconstruction of the bracing system of this animal. To what extent the anatomical conditions in *Phoca* are reflected in the other Phocinae or even Monachinae is hitherto unknown. The investigation of the respective anatomical features will show whether or not the same constructional model is applicable to all Phocinae or Phocidae.
Poster presentation

**New contribution on the presence of singular sauropods in the Jurassic-Cretaceous transition of the Iberian Peninsula (Soria, Spain)**

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The palaeogeographical position of the Iberian Peninsula at the end of the Upper Jurassic and in the Lower Cretaceous favoured the proliferation and development of a singular dinosaur fauna. At this time, the Iberian Peninsula formed part of Laurasia, but it was close enough to Gondwana for the existence of intercontinental bridges between the two supercontinents via Iberia to have been proposed. In this context, dinosaurs with Gondwanan and Laurasian affinities as well as endemisms have been described. To explain this mixture of faunas, the concept of “palaeobiogeographical ambiguity” has been introduced for the dinosaur faunas of the Iberian Peninsula.

In recent decades a singular association of sauropods has been described from the Jurassic-Cretaceous transition of the Iberian Peninsula. These endemic sauropods are a consequence of the isolation of Iberia due to the position of the Iberian Plate between Laurasia and Gondwana during this period of time. In this context a sauropod femur from the Tithonian-Berriasian of Spain is studied for the first time. The femur in question is an isolated specimen, recovered from the Tera Group in Tera (Soria). It displays a mosaic of derived and primitive characters as yet undescribed in the fossil record. A prominent lateral bulge, high eccentricity, and a lateromedially flattened proximal end link the femur from Tera with Titanosauriformes. However, its distally developed tibial condyle suggests that it belongs to a sauropod with a narrow gait, a type of sauropod as yet undescribed in this clade. The femur from Tera might belong either to a basal representative of Titanosauriformes or to a representative of a clade of primitive macronarians that convergently developed a femur similar to Titanosauriformes. The singular nature of the Tera femur thus lends weight to the idea of the presence of a singular fauna of sauropods during the Jurassic-Cretaceous transition of the Iberian Peninsula.
Oral presentation

**New data on the geoemydid turtles from the Late Eocene Maoming Basin, Guangdong Province, China**

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The Late Eocene Maoming Basin is one of the few Eocene localities in south-eastern Asia having yielded a rich aquatic turtle fauna. Three aquatic turtle families are present in that basin: Trionychidae, Carettochelyidae and Geoemydidae. The geoemydid taxon, *Isometremys lacuna*, is poorly known and was described on the basis of internal molds in the 60s (Chow & Ye 1962). It is one of the very few geoemydid species known from eastern and south-eastern Asia during the Late Eocene-Early Oligocene. New geoemydid material from Maoming is then of interest for our understanding of the palaeogeographical range and patterns of morphological diversification in this richest group of living turtles.

The study of new specimens, together with a reexamination of the original material, provides a better understanding of the morphology of *Isometremys*, in particular of the scute pattern: the entoplastron is intersected by the humero-gular and humero-pectoral sulci, the fourth vertebral is short, the pectoro-abdominal sulcus is close to the hyo-hypoplastral suture and there is a deep anal notch. The examination of the material from Maoming reveals the occurrence of a second and new genus of geoemydid turtle in that basin. This taxon is characterized by very short anterior marginal scutes, a narrow first vertebral scute, and a wide and short anterior plastral lobe. This brings to four the number of turtle species known in the Maoming Basin: *Anosteira maomingensis* (Carettochelyidae), *Aspideretes impressus* (Trionychidae), *Isometremys lacuna* and the new taxon of Geoemydidae. In addition to the abundant turtles, the Maoming Basin has yielded cyprinid fishes, eusuchian crocodiles and eomoropid mammals; the whole vertebrate fauna thus predominantly consists of aquatic animals. The turtle fauna differs significantly from older, Paleocene turtle fauna (where representatives of extinct groups are present (*Anhuichelys*, Lindholmemymyidae) and anostereine turtles are rare or absent) and from younger, Neogene turtle faunas (with many modern genera).

References:

Recent fieldwork carried out in the Late Campanian-Early Maastrichtian Sierra Perenchiza Formation near the village of Chera (Valencia province, eastern Spain) has yielded a rich continental vertebrate fauna composed of actinopterygians, amphibians, squamates, turtles, crocodiles, pterosaurs, and dinosaurs (Company, 2004). Among dinosaurs, ankylosaurs are represented by a partial skull, isolated teeth, a synsacrum, appendicular bones (scapulocoracoid, ischium) and several kinds of dermal armour. The partial skull, which is broken just anterior to the orbits, is the best preserved specimen ever found in Europe. The skull architecture resembles to that observed in the nodosaurid *Struthiosaurus*, the only ankylosaurian genus known in the Campanian-Maastrichtian of Europe. The basisphenoid projects ventrally relative to the posterior level of the basicranium, as in *S. austriacus* and *S. transylvanicus* (Pereda-Suberbiola & Galton 1994, 2001). The Chera skull differs from *S. transylvanicus* in having quadratojugal projections and a bowed quadrate in lateral profile. In contrast to the skull of *S. austriacus* (type species), the paroccipital process, the dorsal end of the quadrate and the squamosal of the Chera specimen are fused together. The synsacrum consists of at least eight fused vertebrae, and the presacral rod is broken anteriorly (ten vertebrae in *S. languedocensis*; Garcia & Pereda Suberbiola, 2003). The ischium lacks a distinct midshaft flexion, as commonly in *Struthiosaurus*. Finally, the dermal armour includes fragmentary cervical half-rings, and low and high-keeled scutes. This assemblage improves significantly the Latest Cretaceous ankylosaurian record of southwestern Europe and provides useful information with regard to the relationships of *Struthiosaurus* within Ankylosauria.

References:
Amphibians and lizards from the Upper Cretaceous (Late Campanian – Early Maastrichtian) Sierra Perenchiza Formation (Valencia Province, Spain)

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The Sierra Perenchiza Formation is a Late Campanian-Early Maastrichtian carbonate unit which sporadically outcrops in the southeastern margin of the Iberian Range. In the Chera Basin (Valencia province, eastern Spain) it consists mainly of interbedded carbonate marls and limestones, interpreted as deposits of small ephemeral carbonate lakes and ponds of a coastal environment. These sediments were subaerially exposed and subject to pedogenic processes. Vertebrate fossils are common in such facies, and several outcrops of the area have produced a diverse vertebrate assemblage including dinosaurs, pterosaurs, turtles, crocodiles and microvertebrates (besides eggshell fragments, freshwater invertebrates and plants). Most of the sampled marls yielded a rich microvertebrate fauna, especially fishes, but remains of amphibians and squamates were also identified.

Some robust dentary fragments with a closed Meckelian canal, wide dental shelf and cylindrical, fragmentary pleurodont teeth were screen-washed. These characters suggest that these bones belong to the family Albanerpetontidae. Their exact systematic position is uncertain because of the fragmentary nature of the remains.

A fragmentary right maxilla was also discovered. The teeth are all destroyed in it. However, it is visible that they were thin, cylindrical and pleurodont. On the labial surface, an ornamentation composed of irregular pits is visible. The dental morphology is typical of frogs and this kind of ornamentation is common in pelobatids and gobiatids. However, it is more likely that this remain belongs to the Pelobatidae, since gobiatids are restricted to Asia, while Pelobatidae is present in Europe since the Upper Jurassic.

A small, elongated fragmentary dorsal vertebra was also screen-washed. Its procoelous nature and the presence of synapophyses suggest that it belongs to a juvenile squamate. Between the prezygapophyses, well-developed zygosphenes are visible, similarly to members of the Iguanidae, the Cordylidae, the Teiioidea, the Borioteiioidea, and the Lacertidae. Of these, only members of the Iguanidae and the Borioteiioidea are known from the Cretaceous of Europe. Consequently, this vertebra may belong to one of these, but present information is insufficient for more precise identification.
Amphibians from the Latest Maastrichtian La Solana locality, Valencia Province, Spain

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The Late Maastrichtian vertebrate locality of La Solana is placed in the southeastern margin of the Iberian Range, near the village of Carlet, about 40 km East of the city of Valencia, eastern Spain. This site has yielded a diverse continental vertebrate fauna of crocodilians, pterosaurs, dinosaurs and microvertebrates, as well as remains of freshwater invertebrates, charophytes and carbonized plant remains. The fossiliferous horizons consists of massive overbank mudstones pedogenically modified, interbedded with fine to coarse-grained sand lenses, accumulated in a distal alluvial floodplain paleoenvironment. Screen-washing of several tons of sediment provided a particularly diversified microvertebrate fauna. Besides fishes, which dominate the assemblage, amphibian remains were also identified.

Some rather fragmentary dentaries were discovered with badly preserved but obviously pleurodont teeth. These, the closed Meckelian canal, and the wide subdental shelf suggest that these remains possibly belong to albanerpetontid amphibians.

The screen-washing also yielded several bones of frogs. Some skull and lower jaw elements, such as squamosals and angulars, as well as postcranial bones, including an urostyle, coracoids, ilia and limb bone fragments, could be identified. These bones may represent three frog families.

The slightly curved and S-shaped angulars with a lingually widened coronoid process, which is occlusally high and rounded, are similar to discoglossid angulars. An elongated and compressed coracoid and a single elongated radioulna with a thin diaphysis and shallow articulating facet suggest similar affinities. Therefore, the Discoglossidae are likely to be present in the fauna.

The robust anterior end of the urostyle and the presence of a strong carina on its ventral surface are similar to those of the palaeobatrachids. A fragmentary right pelvis with a subcircular acetabulum, displaying an elongated knob placed anterodorsally to the acetabulum, and a laterally compressed ilium, also indicate the presence of the family Palaeobatrachidae.

The strongly compressed, dorsoventrally and proximodistally widened coracoid and the robust, compressed radioulna with deeply excavated articulating surface are similar to those of the pelobatids, but present information is not sufficient for a more precise identification.

A lot of fragmentary diaphyses of tibiofibulae were also identified; however, they can only be referred as indeterminate anuran remains.
Poster presentation

Jugal remains of hadrosaurine and lambeosaurine hadrosaurids in the Upper Maastrichtian of the Iberian Peninsula (Arén, Huesca, Spain)

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The cranial remains of hadrosaurid dinosaurs are rare in Europe. The best-known and most complete cranial remains are from *Telmatosaurus transsylvanicus* (Nopcsa, 1900). Numerous remains of hadrosaurid dinosaurs have been found in the locality of Arén (Huesca, Spain). Three of these cranial remains, found at Blasi 1 (Arén Formation) and Blasi 4 and 5 (Conques Formation), are jugals. These jugals are the only ones described in Europe except for those of *T. transsylvanicus*. The jugals from Arén differ from those of *T. transsylvanicus* in that they are more slender and present an anterior process shaped like an isosceles triangle. The jugals from Arén are assigned provisionally to the subfamilies Hadrosaurinae (Blasi 5) and Lambeosaurinae (Blasi 1 and 4). The hadrosaurine jugal presents an asymmetrical anterior process along the maxilla-lacrimal contact and a wide jugal neck, while the jugals of the lambeosaurines have an anterior process that is very wide dorsoventrally and symmetrical, a narrow jugal neck, and a maxillary process perpendicular to the antero-posterior axis of the jugal. The hadrosaurine from Arén is the first of this subfamily mentioned in Europe. These remains, plus the remains of the lambeosaurines, show an active interaction with the migratory route that existed between Asia and North America in the Upper Cretaceous.
Oral presentation

**Up in the air: Flying vertebrates from the Maastrichtian of the Hațeg Basin, Romania**

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The Late Cretaceous deposits of the Hațeg Basin, Romania, are world famous for the fossil remains of dinosaurs, as well as other terrestrial vertebrates. For over a century, a range of dinosaurian taxa have been collected from these deposits, first by Baron F. Nopcsa at the end of the 19th Century, when he reported on the occurrence of flying vertebrates, as undetermined pterosaurs. Slightly later, Andrews (1913) described several fragmentary hindlimb elements as *Elopteryx nopcsai*, which he considered to be from a ‘cormorant-like’ bird. These early records of flying vertebrates were subsequently reinterpreted as theropod dinosaurs, thus discounting the presence of flying vertebrates in the Hațeg assemblage.

In recent years there has been a marked increase in the intensity of paleontological research in the Hațeg Basin, especially by screen-washing of sediments from microvertebrate bonebeds. However, although abundant smaller vertebrates have been described, the remains of birds have yet to reported. Pterosaur remains are also extremely rare, with the exception of *Hatzegoteryx thambema*, a giant azdarchid.

We review known Hațeg records of flying vertebrates, and present the first unequivocal evidence of a bird from this basin. This bone, the distal half of a right tibiotarsus has a flexed shaft and a wide extremity. The lateral and medial distal condyles are differently-sized, suggesting that, although incomplete, the Hațeg bird is likely a representative of Ornithothoraces (Enantiornithes + Ornithuromorpha). Medial to a well-developed sulcus extensorius, a marked ridge extends proximally from the proximal surface of the medial condyle. Both cranially and distally, the medial and lateral condyles are separated by a wide and shallow intercondylar sulcus, as seen in all birds and many non-avian theropods.

Besides this avian tibiotarsus, the presence of a diversified flying vertebrate assemblage is suggested by the discovery of several peculiar teeth, most closely resembling those of ornithocheirid pterosaurs. If true, this record would extend the stratigraphic range of the ornithocheirids into the latest Cretaceous and would add another member to the list of ‘relict’ taxa recorded from the Hațeg Basin.
Pterosaurs, like fossil and extant birds, developed an extensive system of air sacs within much of their skeletons. This feature appears to have been of great importance for flying animals and has been linked to roles in physiology and weight reduction or redistribution (Claessens et al. 2009; Witton 2008). While the idea that dorsal ribs also formed part of the pneumatic system is not particularly novel (e.g. Bennett 2001) a new tapejarid specimen (SMNK PAL 3985) is presented here and indicates that pneumatic invasions entered even the smallest of bones, mostly filling them. The rib in question is interpreted to be one of the smallest pterosaurian elements in which a pneumatic system is visible and the bone wall thickness can be accurately measured as being 0.426mm at its thickest point, by the smaller of the two articular heads, and 0.045mm at its thinnest point, by the larger of the two heads. The rib is interpreted as belong to one of the most cranially located thoracic vertebrae and may have been expected to form part of the notarium later in life. The lack of fusion suggests that the animal was still ontogenetically immature and raises questions as to how such small, hollow ribs were capable to withstand the large stresses that they were, presumably, subjected too (Bennett 2001, 2003). The pneumatic system thus appears to have been extensively developed in young animals and to have penetrated even the smallest bones. Further analysis is required to determine the taxonomic distribution of the pneumatic system and how it may have developed within the clade.

References:
Oral presentation

Modelling pterosaur flight dynamics: Initial experimental findings

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Pterosaurs were the first vertebrate clade to evolve true powered flight and have attracted the attention of both palaeontologists and aerodynamicists alike. A number of issues, however, are required to be addressed prior to an investigation into their flight characteristics. As part of an ongoing investigation, the workgroup for Pterosaur Flight Dynamics presents its findings to date. We reconstruct the fore-arm and overall joint mobility based on a number of ornithocheiroid and azhdarchoid specimens along with basal taxa including Dorygnathus. Mass is theoretically altered so experiments can represent both the suggested “light” (e.g. Bramwell and Whitfield 1974; Brower 1983; Chatterjee and Templin 2004) and “heavy” builds (Prondvai et al. 2008; Witton 2008) attributed to these animals and the wing membrane is demonstrated to have extended to the lower leg or ankle. This pattern appears to have been universally present within the clade (Elgin et al in press).

Using the above reconstructions the flight characteristics of several pterosaurian taxa are examined through both theoretical and experimental approaches. A variety of models were flown in a wind tunnel and the resulting data was contrasted with that of other studies (e.g. Bramwell and Whitfield 1974; Brower 1983; Chatterjee and Templin 2004). Subsequent experiments will construct the wing membrane from materials of different structural properties to simulate and allow the development of more complex patagia and their associated aeroelastic characteristics. This approach is central to understanding the flight of large pterosaurs which must have encountered a range of Reynolds numbers during their development.

References:
Poster presentation

New material of *Rhabdodon* from the upper Campanian-lower Maastrichtian of “Lo Hueco” (Cuenca, Spain)

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The Late Cretaceous terrestrial ecosystems in southern Europe, and especially in the Iberian Peninsula, are relatively poorly known. The recently found fossil-site of “Lo Hueco” at the locality of Fuentes near Cuenca (Spain) had provided an abundant assemblage of well-preserved fossils representing most of the macrovertebrate groups described in the Campanian-Maastrichtian of Western Europe. One of these groups well represented in “Lo Hueco” are the ornithopod dinosaurs, and especially remains of the ornithopod *Rhabdodon*. Cranial remains of the genus *Rhabdodon* from the Iberian Peninsula are mainly teeth and incomplete and fragmentary skull bones from several localities, such as Armuña (Segovia), Chera (Valencia), Figuerola de Meià (Lleida) and Laño (Condado de Treviño, Burgos). An almost complete right dentary and an isolated maxillary tooth from “Lo Hueco” can be referred to the species *Rhabdodon priscus*. Previously, some remains had been attributed to this species in Spanish localities, such are the Tremp Basin (Lleida Province) and Cubilla (Soria Province), but these remains are too fragmentary to allow an accurate identification. A large oblique shelf between the alveolar row and the lateral wall of the dentary, parallel dorsal and ventral dentary margins, dentary teeth with a prominent primary ridge shifted slightly distally from the midline of the tooth and enamel thicker on the lingual side of the dentary teeth are diagnostic characters of *Rhabdodon priscus* shared by the “Lo Hueco” lower jaw. Furthermore, the right dentary shares with *R. priscus* the presence of a coronoid process that slopes backward, a condition absent in *R. septimanicus*. Moreover, the isolated maxillary tooth from “Lo Hueco” shares with *R. priscus* the presence of parallel ridges without any prominent primary ridge.

The accurate identification of *Rhabdodon priscus* in the Iberian domain increases the range of distribution of the species to the westernmost end of the South European archipelago, at least, at beginning of the Maastrichtian.
Poster presentation

Fish predatory or escape behaviour recorded in an Early Cretaceous trail from La Rioja, Spain

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The Early Cretaceous continental and freshwater sediments of the Cameros Basin (La Rioja Northern Spain) have yielded thousands of footprints among which are dinosaur, pterosaur, turtle, crocodile and bird tracks. Recently, we described the first discovery of fish trails in the province, in the fluvial sediments of the Oliván Group dated from the Aptian-Albian (Costeur & Ezquerra, 2009). The trails were attributed to Undichna unisulca and supposed to have been produced by pycnodontiform fish that were already known to occur in association with the same kind of trails in central Spain during the Mesozoic. Here we report the further discovery, on the same outcrop of the Oliván Group, of a fish trail that probably can also be attributed to Undichna unisulca but that records a specific behaviour of the fish. Fish are known to dramatically bend their bodies when put at stress or when attacking a prey for almost instantaneously increasing swimming speed either to catch a prey or to escape in directions opposite to predators attacks (Wöhl & Schuster, 2007). These behaviours of acceleration are known as fast-start behaviours. Simulations made with living fish have revealed a C-like movement produced by the fish in bending its body to launch the phase of high-speed swimming (Domenici & Blake, 1997). The fossil trail we describe here shows the starting sequence of swimming as a C-like impression in the sediment. Relatively strong mud rims produced by the pressure exerted by the fish fin on the sediment are preserved around the C-like mark. Following the peculiar C-like structure, the fish continued to swim leaving a 2 meters long trail with a first phase of rather short body undulations wavelengths followed by a second phase of relatively longer wavelengths. The two phases would be consistent with a fast-start and it’s the associated acceleration phase and then by a steady swimming phase. The whole fish trail could have been produced by a prominent caudal or anal fin. A second trace, much less well-imprinted runs parallel along the first one and could have been produced by another fin of the fish. To the best of our knowledge, this very peculiar trail records a behaviour never described before for fossil fish and, after the discovery of swimming dinosaur traces (Ezquerra et al., 2007), highlights one more time the high potential of the area for palaeoecological studies of Mesozoic vertebrates based on the ichnological record.

References:
Oral presentation

**Don't judge a book by its cover: Synchrotron radiation reveals the true nature of the embryos from Phu Phok (Early Cretaceous, northeastern Thailand).**

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In 2005 Buffetaut et al. published the discovery of minute eggs containing embryos from the Early Cretaceous Sao Khua Formation at Phu Phok, a fossil locality in northeastern Thailand. These eggs were described as the smallest known dinosaur (*sensus lato*) eggs. Despite their size, the real interest of the eggs was due to a unique eggshell structure and morphology: The binodular ornamentation was reminiscent of non-avian dinosaurs but the three-layered calcite eggshell suggested a bird-like structure. These eggs therefore appeared to be of prime importance for the question of the dinosaur-bird transition (Grellet-Tinner et al. 2006). To solve this question these eggs have been scanned at the European Synchrotron Radiation Facility in Grenoble, using propagation phase contrast microtomography; a technique known to reveal internal structures which remain invisible when using classical microtomography (i.e. absorption based computed microtomography; Tafforeau et al. 2006). Thus a virtual extraction of the embryos from these fossil eggs has been performed, permitting an anatomical study of the embryonic skeletons. Additionally, high resolution local microtomography permitted to unveil the bone microstructure: the image processing protocol set up by Smith and Tafforeau (2008) allowed generating virtual cross-sections yielding histological information in a non-destructive way. These new data finally solved the question of the enigmatic nature of these embryos. Our results will be presented during the meeting.

References:


Poster presentation

**How certain is the assignment of fossil chondrichthyan egg capsule types to potential producer groups?**

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Predominantly non-marine sedimentary successions of the late Early Carboniferous and throughout the Mesozoic contain fossil egg capsules referable to chondrichthyan producers. Following their interpretation as florescences or fructifications of plants in the earliest descriptions, the spiral band patterns and surface structure in some capsule types have been found to be similar to those in the screw-like eggs of modern heterodont sharks. This assignment is confirmed by the lack of plant cuticles, the strict aquatic context of the capsule fossils, and their co-occurrence with freshwater ichthyofaunas including chondrichthyans. Several egg capsule types (*Palaeoxyris* Brongniart 1828, *Fayolia* Renault & Zeiller 1884, *Vetacapsula* Mackie 1867, and *Scapellites* Pruvost 1922) have been distinguished on the basis of capsule construction and band characteristics. Of the co-occurring chondrichthyan groups (hybodont, xenacanth, and ctenacanth sharks, as well as holocephalians) some have been suggested to be the potential egg capsule producers.

In order to test the hypothesis that hybodont sharks were the producers of *Palaeoxyris* and that *Fayolia* is the capsule type of xenacanth sharks we use a two-by-two contingency table, listing the number of *Fayolia*-xenacanth, *Fayolia*-hybodont, *Palaeoxyris*-xenacanth and *Palaeoxyris*-hybodont co-occurrences in 16 sedimentary successions. We are testing whether the two variables ‘capsule type’ and ‘shark group’ are independent, employing Pearson’s chi-square test and Fisher’s exact test. With the chi-square test delivering a p-value of 0.172, exceeding reasonable alpha levels (0.05, 0.01), the null hypothesis that the co-occurrence of a shark group and a capsule type is coincidental is not rejected. Fisher’s exact test produces a non-rejection as well (one-tail p-value: 0.168). Within five of the considered sedimentary successions horizon-wise co-occurrences of a capsule type and shark remains occur. If these are incorporated as additional observations the chi-square test (p-value: 0.047) and Fisher’s exact test (p-value: 0.0499) lead to a narrow rejection. Apparently, a small number of additional observations could be sufficient to confirm the dependency of ‘capsule type’ and ‘shark group’. Demonstrating that *Palaeoxyris* and hybodonts and *Fayolia* and xenacanths co-occur non-coincidentally does not necessarily indicate the true egg producers – alternatively an explanation from the ecology of chondrichthyan faunas could be feasible (but would not explain the concordance in the stratigraphic ranges).
Oral presentation

**Excavation extreme - ichthosaur hunting in the Torres del Paine National Park, Chile**

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The ichthyosaurs from the Torres del Paine National Park from the area of the Tyndall Glacier are embedded in radiolaritic mud- and sandstone turbidites with a hardness close to granite and an enormous grain density. The site is difficult to access and requires minor climbing abilities. The climate is unpredictable and adds to the problems of an excavation under extreme conditions. In the years before data of the material exposed on the outcrop were collected directly in the field. During the field season in February we tested several methods to get single specimens out of the rock. The work turned out to be much more difficult than expected, especially due to the material properties of the matrix and the fact that the bone is softer than the matrix and exceedingly brittle. Here we report on the specialties of the ichthyosaur site at the Tyndall glacier, failures and successes in the excavation attempts and the excavation methods we would like to apply during the next field trip, the success of which is crucial for further investigations. We also report on the surprises that can happen and the experiences you can collect during several weeks camping in a nature reserve.

References:


Poster presentation

**A spinosaurid cervical vertebra from the Morella Formation (lower Aptian) of Morella, Spain**

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The Arcillas de Morella Formation (lower Aptian, Northwestern of the Iberian Peninsula) has yielded a rich vertebrate fossil record. Dinosaurs are one of the best-represented groups, in particular remains of the ornithopod *Iguanodon* and sauropod titanosauriforms, probably closely related to *Brachiosaurus*. In addition, ornithopods, such as hypsilophodontids and a probable iguanodontid close to *Mantellisaurus*; a thyreophoran, such as *Polacanthus*; and different representatives of theropods, such as spinosaurids, allosauroids and dromaeosaurids, are represented.

A cervical vertebra from the Mas de la Parreta quarry (Morella) belonging to a large theropod, is assigned to a Spinosauridae Baryonychinae. The vertebra is similar to the eighth cervical one of the Lower Cretaceous spinosaurid *Baryonyx walkeri*. As in *Baryonyx*, the Morella cervical vertebra presents the diapophyses in the anterior half of the neural arch, just above the parapophyses and the pleurocoels, large zygapophyses and epipophyses, low and laterally compressed neurapophyses slightly backwards directed, and lacks a lamina connecting diapophyses and zygapophyses. Nevertheless, the Morella specimen just differs from the *Baryonyx* holotype in the development of the epipophyses, more forwards projected in *Baryonyx*, and more backwards directed in the Morella specimen.

The presence in the Morella Formation of a new close relative to other Baryonychinae, such as the European *Baryonyx* or the African *Suchomimus*, has been previously recognized, mainly, due to the presence of similar teeth. However, these teeth show differences with those of both genera.
Molarisation in the notosuchian crocodilian *Malawisuchus* and the cynodont *Procynosuchus*, same thing, same function?

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The evolution of heterodonty and, probably the reduction of a permanent tooth replacement happened at least two times independently in the history of tetrapods, namely among Crocodyliformes and Synapsida. The term heterodonty refers to the differentiation of the dentition into functional subunits, of which the molariform teeth underwent the most obvious morphological changes. The differentiation of the molariform tooth crown enables an animal not only to pierce the food item, but also to squeeze, grind and chop it. The result of such an action is that the food items arrive in the stomach in small pieces or, due to salivation in a porridge-like condition, allowing a rapid digestion. Examples for a high performance molarisation are advanced synapsids, the molars of which showing precise occlusion. During chewing the relief of the crowns of the opposing teeth grind each others into shape. Such a self shaping system can only work, when its components are no longer permanently replaced. Therefore this type of chewing may have triggered the evolution of a diphyodont tooth replacement, however, multicuspid molariform teeth with apparent microwear also occur in advanced notosuchian crocodilians.

Although the transition from anisodont to heterodont tooth morphology can be studied conveniently on abundant fossil material, some important questions remain unanswered: What are the morphological and mechanical prerequisites for the evolution of molariform teeth? When and why did the reduction of the permanent tooth replacement start? Is the reduction of the tooth replacement a necessary precondition for the evolution of self-shaping grinding systems? In order to answer these questions, the molarisation history of synapsids is compared with that of the notosuchians. Both groups show strong anisodonty prior to heterodonty. They have a secondary palate and possess powerful jaw adductor muscles combined with a differently constructed but adequate mandibular lever. Both groups start with strikingly similar molariforms and end up in complex multicuspid molars. With this comparative investigation of Notosuchia and Synapsida it is planned to reveal the evolution of molars and other features related to this process.
Oral presentation

Size-range and intestinal content – hints on the palaeoecology of the fossil ichthyofauna from the Late Cretaceous locality Vallecillo (Northeastern Mexico)

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The Lower Turonian (Late Cretaceous) fossil-lagerstätte Vallecillo (Nuevo León, Mexico) is known for its abundant and well preserved fossil fishes. Most fossils were randomly collected by the quarrymen and scientists when screening spoil heaps and outcrops of the quarry area. Additionally, ten scientific layer by layer excavations unearthed plenty of specimens, which provide quantitative data about absolute abundance and distribution of the fossils. About 900 fish specimens were examined with respect to their palaeoecological signals like locomotor options, feeding capacity, size range etc. According to these investigations the Vallecillo fish assemblage shows several peculiarities with respect to the open marine palaeoecosystem of the Late Cretaceous Vallecillo sea. With 14 different taxa, the fish assemblage shows a low diversity compared to coastal and non-marine plattenkalk-localities. The frequency of the individual taxa varies drastically within the assemblage. The most abundant species is the dercetid Rhynchodercetis followed by the tselfatiiform Tselfatia and the pycnodont Nursallia. These three taxa are known from hundreds of specimens of nearly all ontogenetic stages. Such a pattern of occurrence indicates that these three species were autochthonous elements of the assemblage. This allows conclusions on their palaeobiology, especially concerning their reproduction biology. Much rarer are ichthyodectids and pachyrhizodontids. However these groups are preserved in different ontogenetic stages, too. Dozens of specimens out of these groups of predatory fish show determinable intestinal contents, basically consist of the three most abundant fish groups of the locality.
Oral presentation

*Diplodus ortwini* (Sparidae, Perciformes): a new fossil record of the porgies from the North Alpine Foreland Basin (Egerian, Upper Austria)

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A new representative of *Diplodus* is described from the Egerian locality of Upper Austria. At the same time it is the oldest record of the genus. The author has recently (Gregorova 2009) described the second oldest articulated skeleton of *Diplodus* sp. from Devinska Nova Ves (Upper Badenian, Vienna Basin, Slovakia) and summarizes here the fossil records of articulated sparid skeletons in European Tertiary.

The Egerian species differs from *Diplodus oranensis* (articulated skeleton) from the Messinian of Algeria by a different number of spines in the dorsal fin as well as by the number of dorsal soft rays and from *Diplodus oranensis* and *Diplodus* sp. from Upper Badenian of Vienna Basin (Slovakia) by a different relation of the body parameters.

References:

Non-Darwinian cetology in the Nordic sphere, a source to modern palaeocetology

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Darwin’s *Origin of Species* was an acme of European rationality. Some readers received it enthusiastically, as after long-felt need; others repudiated it. Samuel Beckett, a man of letters, “never read such badly written catlap”, but he appreciated Melville’s *Moby Dick* (Beckett, 1932). Darwin’s major scientific contribution was his explanation for the mechanism of evolutionary change. Systematic classification became evolutionary classification.

Palaeocetology is, on one hand, the analysis of cetacean fossils and, on the other, the study and application of relevant ideas. Work on beaked whales, Ziphiidae, from the Tortonian North Sea represented by fossils from the Gram Formation in Denmark has drawn attention to the appreciable Nordic literary cognizance of, in particular, *døglingen*, i.e. *Hyperoodon ampullatus*, the northern bottlenose whale. Ziphiidae are very highly specialized mammals, possibly comprising the deepest divers among the tetrapods.

Here, attention will concentrate on three Danish authors, none of whom was an evolutionist, but all of whom are esteemed contributors to our knowledge of Ziphiidae. They are Otto Fabricius, Daniel Frederik Eschricht and Herluf Winge, whose lifetimes span nearly two centuries (1744-1923). Shining light on their works shows each author as a child of his age and place. Otto Fabricius was a Nordic *enfant des lumières*, traditional by graduating in divinity and taking up work as a protestant missionary in Greenland and by writing in Latin, and novel by his wholehearted exploratory openness to nature and peoples. He arrived at Frederikshaab / Paamiut with Linnaeus’ *Systema Naturae* and settled among the Greenlanders, whose travel and hunting methods he acquired. His work leading to *Fauna Groenlandica* (1780) was delayed by numerous changes in his life situation presumably causing the lapse of memory that made him indicate two small tusks anteriorly in the upper jaw of the otherwise edentulous *anarnak*, Greenlandic for *H. ampullatus*, so misguiding him to group it systematically with the narwhal. His other observations on this sole ziphiid in the West Greenland waters were significant and new to science. D.F. Eschricht was a cetologist of Cuvierian views. His collaboration with collectors, such as Captain Holbøll, secured a fine collection of cetacean skeletons to Copenhagen University, and his article on the beaked whale (*H. ampullatus*), *Om Næbhvalen* (1845), is an excellent study of anatomy. Denmark’s friendship with Napoleonic France became severely punished by England and her allies, and nationalism increased, so Eschricht published in Danish. Parts of his work became translated into English by W.H. Flower. Herluf Winge was a great anatomist whose systematic work on mammals, *Pattedyr-slägter*, was published around the time of his death in 1923. His ideas of cetacean interrelationships appeared in English in 1921. Winge adhered to Lamarck’s views. In their personal correspondence Darwin regretted that Winge did not accept his evolutionary theory. Joh.V. Jensen (1927), a contemporary Danish man of letters who described Winge with a sympathetic insight, found a reason in Darwin’s strong emphasizing of the struggle for life, which did not comply with Winge’s sensitive mind.

References:

Oral presentation

**Ancient DNA from Holocene beavers (Castor fiber) in Europe**

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During most of the Holocene, the Eurasian beaver (Castor fiber) was widely distributed throughout Eurasia and constituted a key species of the temperate forest fauna. As a result of intensive hunting, a drastic reduction in population size occurred from medieval times up to the late 19th century, reducing the beaver’s range to isolated relict populations and obliterating most traces of pre-hunting population structure. Identifying this ancient population structure as well as potential glacial refugia, which could have acted as sources for the post-glacial resettlement of Central and Northern Europe, is beneficial for the conservation of this protected species.

Ancient DNA techniques were used to retrieve mitochondrial DNA sequences from Central and Northern European beaver samples predating the population size reduction. Using these sequences we reconstructed the pre-hunting beaver phylogeography, potentially identifying source populations for the resettlement of Europe after the last glacial maximum (LGM). Preliminary results show that the ancient DNA sequences from Slovenia, the North Sea and Southern Norway group with the extant Western European relict populations, while Northern Norwegian samples were found to be more closely related to extant Eastern European and Asian beavers. Most interestingly, ancient Romanian samples form a divergent, previously unknown group, suggesting that a separate refugial population existed in the East of Europe during the LGM.

Additional sampling from the entire former geographical range of the beaver, especially from potential refugia, is currently being conducted. Therefore we are still looking for additional collaborators providing Holocene and late Pleistocene beaver specimens from Europe and Asia for ancient DNA analyses.
Poster presentation

**Aspects of constructional morphology of Mustelidae and Viverridae (Carnivora)**

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With a few exceptions in Mustelidae and Viverridae the limb/trunk ratio is smaller than in other Carnivora. In this respect, the construction of Mustelidae and Viverridae resembles that of lizards. Lizards exclusively use horizontal body undulation for propulsion. Due to the constraints of a mammalian construction, most carnivores use vertical oscillations during gallop. During slow walk, a lateral undulation component with a caudally increasing amplitude occurs in mustelids and viverrids, especially in those with a long trunk. The models of mammalian bracing systems and locomotion biomechanics have been mainly reconstructed for animals with a trunk that contributes little to propulsion. These models are a comparative base for the reconstruction of the mode of operation of the mustelid and viverrid construction.

Comparative anatomy, biometry, and kinematics of selected species of Viverridae and Mustelidae allow a detailed functional analysis of their musculoskeletal apparatus with respect to locomotion and other movements. Some of the operational options, however, cannot be concluded from one structure only. This makes an analysis of the locomotion and other movements necessary. The suricate (*Suricata suricatta*), e.g., uses scratch digging for creating tunnel systems and for searching prey. However, the skeletal dimensions and robustness of the long bones resemble more that of a mammalian accelerator. Furthermore, the vertebral column of the suricate is shorter with respect to the limbs, compared with other Herpestinae with their robust long bones with prominent projections like other scratch diggers. However, the lever arms of the muscle forces in the limbs of the suricate allow for powerful digging. For digging, exclusively the front limbs are used, either simultaneously or alternatingly, while the hind limbs bear the body weight and compensate the lumbar oscillation in the acetabulum. In contrast, the banded mongoose (*Mungos mungo*) with its long body and short limbs compared with the suricate, shows many features of a digger, but mostly digs with one front limb, while the other remains on ground. Among Mustelinae, the polecat (*Mustela putorius*) with its enormously long body relative to the limbs is a mainly terrestrial hunter on large prey with excellent acceleration capabilities. With their flexible trunk they can master all kinds of substrate. The short legs allow rapid locomotion in burrows. At the same time, the animal can perform limited climbing and digging with alternatingly working front limbs. During digging, the body is often braced against an object or the ground. The autopodia are broad and able to grasp, like in other Mustelidae.
Oral presentation

A new late Pleistocene mammal locality from Western Crete, Greece

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During the last four years systematic explorations of the Natural History Museum of Crete have added more than 20 Pleistocene fossil localities around Crete to the catalogue of the over 70 already known on the Island. The new localities are distributed in all four prefectures of Crete. The most important of these is the newly discovered site of Koutalas at Cape Drapano in Western Crete. The fossil remains are found in two levels and in red cemented clays of a collapsed cave. In the upper level a rich assemblage of micromammal, bird and large mammal remains has been discovered. The large mammals consist of dwarf hippopotamus (*Hippopotamus creutzburgi*) and elephants (*Elephas* sp.). A partly articulated skeleton (vertebral column, mandible and few long bones) of a dwarf hippo has been found next to a deciduous molar of an elephant, indicating that the two taxa probably coexisted. The micromammal remains belong to the giant Cretan mouse *Kritimys catreus*. Therefore, the age of the assemblage is dated to the *Kritimys catreus* zone and thus to the late Middle Pleistocene. In the lower level scattered remains of deers, birds and micromammals have been identified, and their age is most likely younger than that of the upper level.
Poster presentation

**Middle Jurassic vertebrate faunas from the lignites of the Causses (southern France)**

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The Causses are a group of limestone plateaus situated in southern France. Two ensembles are usually recognized: the Grands Causses and the Causses du Quercy. They are situated in the South of the Massif Central and on its western margin, respectively. Continental lignitic deposits in the Causses have been known and exploited since prehistoric times. The first references to vertebrates from these horizons date from the XIXth century, but the most significant results were obtained by German researchers much later. The various layers are not coeval. The lignites from the Grand Causses are usually considered as basal Bathonian. However, some data suggest a somewhat younger, but still Bathonian, age is likely. The lignites from the Causses du Quercy may be slightly older, most of them being probably latest Bajocian or earliest Bathonian. In the Grands Causses, the greatest number of outcrops is found near the Dourbie and Trezezel valleys and in the surroundings of La Cavalerie. Lignite layers more rarely occur in the Causses du Quercy. The most notable ones are found in the Cajarc area and at Limogne-en-Quercy. Although a small number of sites were sampled and a limited amount of sediment was processed, the vertebrate faunas evidence a remarkable diversity. Some faunal differences are apparent between the Grands Causses and the Causses du Quercy. They are in rough accordance with the -probably simplistic- hypothesis according to which the marine influence is stronger in the former than in the latter. Thus, the strictly marine actinopterygian *Aspidorhynchus* has been found so far only in the Grands Causses, whereas the Quercy locality of Larnagol has yielded a surprising number of primitive ornithischian teeth. However, much more work is necessary before any unambiguous picture emerges.

Acknowledgements: Recent prospecting in the Grands Causses has been supported by Terra Memoria (Bozouls). FK holds a “Ramón y Cajal” research contract from the Ministerio de Ciencia e Innovación (Madrid).
The Late Permian mass extinction has been a much discussed problem over several years. As possible causes among others, flood-basaltic eruptions, changes in atmospheric composition, climatic changes and impact events were suggested. Lystrosaurus survived the Permian-Triassic boundary as one of a few genera and thereafter dominated the Lower Triassic vertebrate fauna. The question of the advantage of Lystrosaurus’ lifestyle which enabled Lystrosaurus to survive the End-Permian mass extinction arises with respect to the evolutionary success of Lystrosaurus. In relation to this lifestyle of Lystrosaurus its characteristic skull structure was controversially discussed. Several hypothesis were suggested: a) an aquatic or semi-aquatic lifestyle, b) a terrestrial and fossorial lifestyle including the existence of a shock absorption system of the skull for burrowing and an adaption of the skull to crush resistant plant matter and c) an adaption to hypoxia.

First examinations of a skull of Lystrosaurus declivis by neutron tomography brought to light complexly maxilloturbinal-like structures in the nasal cavity. Maxilloturbinals are an attribute of mammals in general and entirely unknown in reptiles, which emerged together with permanent ventilation and endothermy. In addition, there are pneumatized bones like premaxilla, maxillae and dentary in the Lystrosaurus skull with canals to the nasal chamber, the external nares and the oral cavity. It seems probable that these structures were responsible for secretion and moistening the respiratory air passages and the oral cavity as a protection against dust. These results support the hypothesis that Lystrosaurus was well adapted to drought continental conditions and a fossorial lifestyle. Furthermore the characteristic skull structure can be explained with an evolutionary trend to extended air passages and increasing volume of the nasal chamber and pneumatized bones. The same results strongly suggest that Lystrosaurus had an efficient respiration and an endotherm metabolism. Theses adaptions might have been the resaon that Lystrosaurus survived the extreme Late Permian changes in climate and atmospheric composition.
Several interesting assemblages of fossil vertebrates have been discovered in the area of Nalut in northwestern Libya during sedimentological studies. The different outcrops belong to the Cabao Formation, a shallow marine to continental unit overlying the Late Jurassic Shakshuk Formation and overlain by the Kiklah (or Chicla) Formation of possible Albian age. The faunal list includes the hybodont shark *Priohybodus*, the crocodilian *Sarcosuchus* and several dinosaurs including an abelisaurid, a baryonicine spinosaurid (cf. *Baryonyx*) and a large sauropod with spatulate teeth. Most African sauropods in the Late Jurassic and Early Cretaceous belong to several neosauropod clades such as the Brachiosauridae, Rebbachisauridae, Diplodocidae or Titanosauriformes. The large spatulate tooth that we report here has closer affinities with camarasaurs (which are so far known from North America and Europe only) than with Turiasauria, the Nigerian sauropod *Jobaria* or isolated teeth from Niger referred to *Rebbachisaurus tamesnensis* by Lapparent.

Some argillaceous and silty intervals at the base of the Cabao Formation close to the Tunisian border are probably a lateral equivalent of the Tunisian Douiret Formation, a unit that Tunisian geologists refer to the Aptian on the basis of its geometrical position above Hauterivian to Barremian-Bedoulian levels of the Boulouha Formation [the latter being dated by the occurrence of the Late Hauterivian to Early Aptian (Bedoulian) rhyynchonellid *Loriolithyris russillensis*] and below the Chenini member of the Upper Aptian to Albian Aïn Guettar Formation. The Douiret formation (which has yielded a few vertebrate remains) can thus be considered as Barremian-Aptian in age. The Cabao Formation is also probably Barremian to Aptian in age. Its dinosaur assemblage is reminiscent of that of the El Rhaz Formation of Niger, which would suggest a similar age for this unit.

The Barremian-Aptian African vertebrates are markedly different from the Cenomanian assemblages of Morocco or Egypt, but also from the Late Aptian to Albian fauna of Tunisia, with the replacement of baryonicine spinosaurids by spinosaurines (i.e. *Spinosaurus aegypticus*), the disappearance of sauropods with large spatulate teeth and that of the shark *Priohybodus*. Further investigations in the poorly dated deposits of the Continental Intercalaire of the Sahara should allow more correlations based on the vertebrate assemblages.
The development of large vertebrate suspension feeding in the Mesozoic

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Assessment of the suspension-feeding abilities of extinct marine animals has traditionally been done through application of isolated criteria, for example, edentulous, or large (comparative) size, or elaborated gill structure. Application of more rigorous assessment through utilisation of Motta’s 1995 characters as indicators of suspension-feeding challenges the researcher to find more lifestyle markers consistent with such behaviour. Although the current ecological niche of large (>1 metre Standard Length) suspension-feeding marine vertebrate is today dominated by mammals and chondrichthyans, it appears that this ecospace was exclusively occupied by osteichthyans during the Mesozoic era.

Until recently, the only Mesozoic animal cited in the literature as a definite osteichthyan equivalent to today’s Cetorhinus and Rhincodon was the unusually large Middle Jurassic (Callovian) pachycormid Leedsichthys problematicus (S.L. 8.9 metres), recovered from England, France, Germany and Chile. In addition to its size, the pattern of this pachycormid's fins and its long closely-spaced gill rakers both argue for it to have had a suspension-feeding lifestyle. Contemporaneous trace fossils in Switzerland have been interpreted as signs of secondary iliophagous behaviour of this fish. Recent work has indicated not only the presence of a second edentulous suspension-feeding pachycormiform in the Callovian of England (Martillichthys renwickae), but also other similar candidates ranging from the Lower Jurassic (Toarcian) to the Lower Cretaceous (Albian). It appears that, far from being a lone osteichthyan experiment in suspension-feeding, Leedsichthys was simply the largest example of a Mesozoic lineage of pachycormids occupying this niche.
The fossiliferous area of Cerro de los Batallones (Madrid, Spain) is one of the most important sites in the European Miocene for its extraordinary richness and the excellent state of preservation of its fossils. It consists of nine vertebrate traps (numbered from Batallones 1 to Batallones 10) dated as late Vallesian (Late Miocene). The fossil record is characterized by the prevalence of carnivores (more than 90% of the remains representing no less than 12 species). The micromammals come second in relative abundance and include insectivores, lagomorphs, and rodents. A detailed study of the cricetodontinae rodent *Hispanomys*, whose remains have been recovered so far only at Batallones 1, 3, 5, and 10, has been carried out. This work has evidenced that the species represented at Batallones is new. It shows some progressive characters with respect to the older species of the genus such as the absence of cingula surrounding the upper and lower molar valleys, the reduction and simplification of the third molars. It also evidences trends to increase the number of roots on the first upper molar, to have stronger and higher ectolophs, and to lose the mesoloph on the upper molars. In addition, a high morphological variability has been demonstrated: the hypodigm comprises teeth with advanced, more primitive, and intermediate morphologies. The material from the type locality (Batallones 10) is rather plesiomorphous (with well-developed anterolophid on the lower molars and four-rooted M1). The specimens from Batallones 3 (with short or absent anterolophid on the lower molars and five-rooted M1) are the most evolved ones, whereas those from Batallones 1 are intermediate between Batallones 10 and Batallones 3. This morphological variation is interpreted as due to slight age differences between the localities. Thus, Batallones 10 would be the oldest locality, followed by Batallones 1 and Batallones 3. The scarce material found at Batallones 5 shows quite derived morphologies and it is, therefore, most likely more recent than Batallones 10 and Batallones 1, but its situation with respect to Batallones 3 remains unclear. This may indicate that the filling of the Batallones cavities had a geographical direction, starting from the South and progressing towards the North.
Oral presentation

A kinetic/dynamic look at sauropod locomotion

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The locomotion capabilities of sauropod dinosaurs have often been compared to those of elephants. Both groups have parasagittal and columnar limbs, with flattened femur and humerus shafts and low cnemial crests. Sauropods have limb bone strength indicator values slightly lower to slightly higher than elephants. Therefore, it seems indeed sensible to assume that sauropods had similar limb kinematics and relative walking speeds as elephants.

In recent years, the locomotion of elephants has been studied in detail, with surprising results. Asian elephants can achieve top speed of almost 7 m/s, use up to 77% of their limb joint motion range, much more than often assumed, and at high speeds (Froude numbers ~>1) change their limb kinematics to use compliant limbs, if not spring-like whole-body motions.

Slow walking with an inflexible trunk, without lateral body motions, and constant three-point support has been modeled for sauropods. However, these limitations are unwarranted. Kinetic/dynamic modeling in NASTRAN allows a more accurate assessment of support, because it takes inertia and inertia transfer into account. It indicates that sauropods could certainly use two-point support gaits, potentially even one-point support, with similar footfall patterns as extant elephants. The most stable gait appears to be a lateral sequence single-foot walk with, especially at high speeds, a 25% phase offset between limbs. At medium and low speeds, however, this requires significant later motions of the body. Alternatively, constant three-point support is required, which limits the animals to very low speeds.

In sum, it becomes apparent that elephants can be used as extant analogues for sauropod locomotion. However, at high speeds elephant locomotion involves elastic processes that are nearly impossible to reconstruct in sauropods, due to the lack of soft-tissue anatomy information. Therefore, they can be cautiously assumed to be similarly athletic as elephants, but further research, especially detailed musculoskeletal modeling, is required.

References:
5. Bakker 1986 Dinosaur Heresies
Oral presentation

**A closer look at published data matrices reveals support for the "lepospondyl hypothesis" on the origin of Lissamphibia**

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Despite decades of intensive research, the origin of the extant amphibians remains controversial. The latest few published morphological phylogenetic analyses of limbed vertebrates have supported three hypotheses: a monophyletic Lissamphibia nested in the temnospondyls (the “temnospondyl hypothesis”/TH), the same nested in the lepospondyls (the “lepospondyl hypothesis”/LH), and some extant amphibians as lepospondyls and others as temnospondyls (the “polyphyly hypothesis”/PH). We have tested the accuracy of three recently published data matrices which supported the PH (McGowan, 2002; Anderson et al., 2008) or the TH (Ruta & Coates, 2007), and disagree with the scoring of many cells; this includes a spectrum from differences of interpretation of how to delimit character states or whether to split or merge characters, over cases where states of ontogeny-related characters in immature or paedomorphic specimens were taken at face value instead of scored as unknown, all the way to (numerous) unambiguous mistakes that may be explained as typographic errors. We have also ordered all continuous multistate characters. We disagree with the scoring of 35% of the cells in McGowan (2002); when these are changed, the TH results, and if the lepospondyl *Brachydictes* and the temnospondyl *Gerobatrachus* are added, or if *Doleserpeton* is considered morphologically immature, the LH results (Marjanović & Laurin, 2008). The matrix by Anderson et al. (2008), which accompanied the description of *Gerobatrachus*, strongly supports the LH when rescored. Preliminary work on the matrix by Ruta & Coates (2007) similarly finds support for the LH to be highest. We thus confirm the previous finding that errors in data matrices have a large impact on the results of phylogenetic analyses. We further offer new interpretations of the skull roof of *Brachydictes* and the teeth and tarsus of *Gerobatrachus* and suggest, based on (in part recent) literature, that pedicellate teeth could be more widespread than usually thought. Finally, as occasionally suggested in the literature, Albanerpetontidae could be the sister-group of Lissamphibia rather than a member of it. More research on these topics is necessary.

References:


Oral presentation

**Narrow- and wide-gauge sauropod trackways with similar track morphology and trackway configuration from the Late Jurassic of NW Switzerland: Brontopodus and/or Parabrontopodus?**

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Sauropod trackways from the Late Jurassic of NW Switzerland vary between narrow-gauge and very wide-gauge when the pes trackway ratio of Romano et al. (2007) and the ratio introduced by Marty (2008) between the width of the pes angulation pattern and the corresponding pes length (i.e., [WAP/PL]-ratio) are applied. So far, studied trackways include several narrow-gauge and one very wide-gauge trackways from a single tracklevel and medium-gauge to very wide-gauge trackways from another slightly older tracklevel. Marty et al. (2003) assigned the narrow-gauge type to the ichnogenus Parabrontopodus based on typical trackway characteristics (i.e., pronounced narrow-gauge, strong heteropody, outwardly rotated manus), later on Marty (2008) tentatively assigned the medium-gauge to very wide-gauge trackways to the ichnogenus Brontopodus because of their clearly wider gauge. However, the pes and manus tracks of all studied trackways, even though most of them are not very well preserved, have a very similar morphology: pes tracks longer than wide, oval in shape, and occasionally exhibiting digit impressions; manus tracks (if undeformed by the subsequent pes) wider than long, semicircular or slightly horseshoe-shaped, and without evidence for a claw impression on digit I. Apart from the marked difference in gauge, they further exhibit a similar general trackway configuration: strong heteropody, pes and manus rotated outwards, manus showing a higher outward rotation than pes, and centres of manus tracks being placed farther away from the trackway midline than those of the pes tracks.

Therefore, the assignation of the studied trackways to the two distinct sauropod trackway types narrow-gauge (e.g., Parabrontopodus, Breviparopus) and wide-gauge (e.g., Brontopodus), based on differences in gauge alone, is problematic. We assume that the gauge of the studied trackways is not only related to the variable posture of different taxa (basal and more derived sauropods), but it may also have been influenced by other parameters such as substrate consistency, behaviour, speed or ontogenic stage. We plan to analyze all (currently 177) sauropod trackways including well-preserved tracks with anatomical details (i.e., digit and claw impressions) of NW Switzerland in a consistent way, to make preservational and sedimentological analyses, and to compare them with other known sauropod ichnotaxa, in order to clarify their ichnotaxonomical assignation.

References:


The sex ratio in Irish giant deer: bachelor parties or a series of unfortunate accidents?

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Hundreds of specimens of *Megaloceros giganteus* (Blumenbach, 1799), the Giant Deer, have been collected from cave and bog deposits across Ireland, many examples are housed in National Museum of Ireland (Natural History), Dublin. Historical records and collections data show the Irish record of Giant Deer to be dominated by males, with large skulls and huge antlers. Three possible explanations of this skew are: 1) Males, being larger and heavier, were more prone to miring on lakeshores; 2) Heavier males would tend to drown in frozen lakes with a higher frequency; 3) The single-sex accumulations reflect the existence of ‘bachelor herds’ of young males. Giant Deer show clear dimorphism when the skull is present in the form of antlers but isolated material could be assigned to the correct species and sex with quantitative techniques. Morphometric measurements collected from skeletons of Fallow and Giant Deer were collected and multivariate analyses discriminated between the two species with high reliability and correctly sexed individuals. The technique also identified “chimeras” and “cryptic” females in the Dublin collections, enhancing the scientific value of the collections.

By combining geological, taphonomic and morphometric data with insights from isotopic analyses of tooth enamel that can pinpoint the season of death of individuals will allow rapid progress in establishing which of the three explanations is the most likely. Our interdisciplinary investigations will yield new insights into the macroecology of Irish deer populations towards the end of the Last Glacial Maximum (~12,500 ybp).
Oral presentation

The early rise of sauropods – Evidence from the Late Triassic of the Eastern Swiss Alps

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Combining the skeletal and trace fossil record has continuously led to new insights into the early evolution of saurischian dinosaurs. For instance, the coeval existence of prosauroptod and sauropod dinosaurs led to the conclusion that they are sister taxa. However, the timing and the origin of sauropodomorph body or trace fossils still remain under debate? Up to now Antenonitrus from the Norian of South Africa was regarded as the earliest quadrupedal sauropod body fossil. However only recently Panphagia from the Ischigualasto Formation (Carnian) has been coined as the oldest basal sauropodomorph. The oldest trackways that display sauropod synapomorphies are known from the Lower Late Triassic (Carnian) Portozuelo Formation of Argentina, but their identification remains tentative. So far the oldest sauropod ichnotaxon is Eosauropus from the Chinle Formation (Norian/Rhaetian) of Western North America. The Chinle tracks show manual and pedal ungual traces and were attributed to sauropods. The oldest sauropod tracks with slightly reduced manual phalanges (more advanced) are known from the Early Jurassic (Hettangian/Sinemurian) Lavini di Marco site in Italy, those from coaxal strata in Morocco are herein assigned to the ichnotaxon Lavinipes.

We report here on the presence of unequivocal sauropod footprints from the lowermost part of the Kössen Formation (Alplihorn Member; Late Norian) from the Central Austroalpine Ela nappe (Southeastern Switzerland). The surface comprises approximately 96 m² and shows so far an incomplete 19 m long trackway with a total of fourteen footprints. They represent the oldest record of advanced sauropod tracks - in respect to ungual and phalangeal reduction - in the world. Moreover, a helicopter survey undertaken in 2008 revealed several surfaces with new tracks, notably a clearly trampled surface with advanced sauropod footprints. However those are situated in the Norian Hautpdolomit Member and most probably constitute the oldest tracks of more advanced sauropods so far reported anywhere.
Oral presentation

The fish fauna of Grube Unterfeld (Oligocene, Rupelian; Baden-Württemberg, S Germany): Updated information

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About 32 million years ago, during the Rupelian stage of the Oligocene, a waterway established a connection between the North Sea and the prealpine marginal sea. At the bottom of this sea, sands and clay stones were deposited which formerly were exploited in numerous sand- and clay pits along the Upper Rhine Rift Valley. One of them is Grube Unterfeld, which is located close to the small village of Frauenweiler, about 13 km S of Heidelberg (Baden-Württemberg, S Germany). Unfortunately, the quarrying activities became uneconomical and were stopped some years ago. Since that time, the pit was used as a commercial landfill and it is almost completely backfilled with building rubble and ground excavation materials today.

Grube Unterfeld is well-known as an important locality for palaeontologists and neontologists who are interested in the developmental history and the relationships of Cenozoic marine fish taxa and fish associations in the W Parathethys. It is also famous for outstanding records of other vertebrate groups (e.g., the first finds of an Old World hummingbird and a carnivorous mammal of the genus Apterodon), and invertebrates, too. Many fossils are completely articulated and transfer-prepared specimens provide excellent information concerning even highly delicate and fragile morphological structures.

Synopses of the fish fauna and descriptions of particular taxa display a broad scope of more than 70 nominal genera and species. Detailed studies of their systematics and morphology will not only result in the recognition of additional forms but will also shed new light on the evolution, life history and palaeodiversity of numerous elasmobranch and bony fish groups. Only recently, a partially articulated skeleton of a sand tiger (Carcharias gustrowensis) was described, with several embryos in situ. And within the bony fishes the first fossil specimens of the tholichthys larval stage of a butterfly fish (Chaetodontidae) were found. Most fish species are dominated by juvenile forms. There is a vast majority of shallow water species, some of them even indicate fresh- or brackish water influence. By contrast, there also are several mesopelagic forms. New records of benthic groups (e.g., Triglidae, Lophiidae) show, that the anoxic conditions probably existed in the uppermost bottom layers and not in the water column.
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Oral presentation

**Vertebrate tracks in Late Pleistocene? coastal aeolianites in Pafos, Cyprus**

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Vertebrate tracks are commonly encountered in coastal aeolianites throughout the Mediterranean area. In 2005 numerous tracks were discovered by Theodorou (Project UOA Research account 7093 and 3370) in Aeolian deposits in and around the town of Pafos in the south-western part of Cyprus. The main trackbearing exposure is located in the protected archaeological site near Ayia Solomoni church inside the city of Pafos, where cross-sections through tracks are abundant in the vertical exposures of the aeolianite. Some exposures show as many as 10 tracks per m² in vertical exposure. Several additional tracks were found in the extensive subterranean tomb complex, Tombs of the Kings, just outside Pafos. The aeolianite was formed when Westerly to southwesterly winds drove fine- to medium-grained calcareous sand onshore from the beach, generating 1 – 2 meter-thick eolian crossbed sets composed of both grainflow and wind-ripple strata, and sand sheets composed entirely of wind-ripple strata. Large rhizoliths are common, and thin-sections reveal meniscate calcite cements as well as abundant micrite envelopes. Although dissolution of aragonitic skeletal material led to rapid lithification by vadose calcite, the smooth folds we interpret as tracks must have been emplaced in uncemented sand quite soon after its deposition. The animals made their tracks on a low-relief landscape composed of partly vegetated, small dunes and eolian sand sheets. The sediment does not have yet an absolute date, but is expected to be of similar age to other coastal aeolianites from the Mediterranean area, which is Late Pleistocene to Early Holocene. This age is supported by the fact that no Pliocene or Early Pleistocene mammals are known from Cyprus. The Late Pleistocene endemic fauna in Cyprus were limited to dwarf hippopotamus *Phanourios minor*, dwarf elephants *Elephas cypriotes* and a small carnivore *Genetta plesictoides*. The majority of the studied tracks are 5 – 15 cm in diameter, with few tracks up to 23 cm in diameter. This range of size correlates well with the estimated foot size of dwarf hippopotamus and dwarf elephants. This limited endemic island fauna gives a unique opportunity to correlate tracks with trackmakers.
Here we present two bats from the late Middle Oligocene (Rupelium) clay pits in the vicinity of the Cities Rauenberg and Frauenweiler. There were altogether three clay pits between Rauenberg and Frauenweiler: two, the clay pits “Frauenweiler-Wiesen” and “Rohrlach” north of the highway A6 and the clay pit “Unterfeld” south of it. The clay pit Unterfeld is under re-cultivation since 2007. The other clay pits are re-cultivated since many years, and today they are protection areas for water birds and amphibians. The Rupelian clay sediments from these pits, especially the “Fischschiefer” (“fish shale”) from the clay pit “Unterfeld”, are world famous for their exceedingly diverse fish assemblage, which comprises about 70 described species (MICKLICH & HILDEBRAND 2005). Other marine vertebrares, like Sea cows (cf. Halitherium), and marine turtles are known from a few specimens only. Occasionally, vertebrares from the nearby coastal and terrestrial environments have been found. Whereas several species of terrestrial birds have been described (MAYR 2000, 2004, 2005, 2007), the only evidence for terrestrial mammals until now is one fragment of a creodont mandible (cf. Apterodon) and two bats. One of these bats is preserved as slab and counter slab. The specimen has been transferred in resin and is now housed in the State Museum for Natural History Stuttgart. This bat is badly preserved and incomplete. Most of the bones are broken and lie dislocated of the slaps. The skull is incomplete although, however, the three molars in the upper jaw and the right canine in the lower jaw identify this specimen as a belonging to the genus Myotis. The second specimen is reposited in the collection of the City Museum in Bruchsal Castle. It is better preserved, but lacks the right wing distal to the proximal half of the humerus and the right hindlimb distal to the proximal third of the femur because of the breakage of the slab. Unfortunately no diagnostic feature is visible on this specimen. However, the Bruchsal specimen is 1.4 times bigger than the Stuttgart one and therefore represents a different species.

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Micklich, N., Hildebrandt, L. (2005): The Frauenweiler clay pit (Grube Unterfeld); Kaupia 14: 113-118
Dinosaur tracks from the Tiouraren Formation near Azènak (Republic of Niger)

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In 2006, a dinosaur cemetery was found in the plains SW of Agadez (Irhazer wan Agades) near Azènak in the Republic of Niger. The sediments exposed are continental red beds of the Mesozoic placed in the Tiouraren Formation (Middle Jurassic - Early Cretaceous) of the Irhazer Group, in geological maps often labeled as “Continental Intercalaire”. A precise age assignment is actually impossible, but palaeobiological data of the findings collected in two digging campaigns 2007 and 2008 indicate hitherto a Middle to Late Jurassic age. In addition to bone material, some dinosaur tracks were found in the vicinity of the excavation site preserved in a 3-5 cm thick siltstone layer of a slightly lower bed in the same lithological unit. Seasonal fluvial erosion in an active wadi system exposed app. 50 m² of the siltstone layer’s surface showing most of the tracks. They are preserved as pes impressions in the original track bearing strata with occasional undertracks where the siltstone layer is lost due to weathering. Deep impressions with thick sediment bulges imply high water content of the unconsolidated sediment. All the footprints of the main trackway are didactyl, lack heal pads, and show characteristic theropod pes features with two functional toes (digit III and IV). In good state of preservation the slight impression of a modified third toe (digit II) combined with a faint scratch mark (sickle claw mark?) is visible.

Average footprint dimensions: width 23.1 cm; digit III, 27.5 cm length, 6.6 cm width; digit IV, 20.8 cm length, 4 cm width; angle between digit III/IV, 5°.

The main trackway shows footprints in both directions – back and forth. Impressions in SW direction are often disturbed by impressions in NE direction. We recognized 5 different trackways with 120 footprints all from the same kind of trackmaker. Each trackway is made up of 10-30 alternating footprints with variable distance between them and values of around 180° for pace angulation. An average pace length of 117 cm (min. 80 cm, max. 150 cm) and the deep pes impressions indicate a rather slow, cautious movement of the animals with changing velocities. Overall features of the tracks imply an early member of the family Dromaeosauridae in Gondwana as possible trackmaker.
Oral presentation

The evolution of vertebral counts in fossil and extant amniotes

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The development of distinct regions in the vertebral column of amniotes results from somite formation and Hox gene expression, with the adult morphology displaying remarkable variation among lineages. Mammals are reportedly very conservative or even constrained, but there has been no study investigating vertebral count variation across Amniota as a whole, undermining attempts to understand the phylogenetic, ecological, and developmental factors affecting vertebral column variation. Here, we show that the mammalian (synapsid) and reptilian lineage show clear divergences in axial developmental plasticity both in terms of regionalization and meristic change early in their evolutionary histories, with basal synapsids sharing the conserved axial configuration of crown mammals, and basal reptiles demonstrating the plasticity of extant taxa. We conducted a comprehensive survey of presacral vertebral counts across more than 400 recent and extinct amniote taxa, mapped vertebral counts onto generalized phylogenies, and reconstructed ancestral states using squared-change parsimony. We also calculated the relationship between presacral and cervical numbers to infer the relative influence of homeotic effects and meristic changes, and found no correlation between somitogenesis and Hox-mediated regionalization in any amniote clade. While conservatism in presacral numbers already characterized the early synapsid lineage, both reptiles and synapsids share the same tendencies of developmental innovations as adaptations to marine habitats and the evolution of dermal armor. Conversely, increases in body mass are not coupled with meristic or homeotic changes, but occur in concert with postembryonic somatic growth in most lineages. Our study highlights the importance of fossils in large-scale investigations of evolutionary developmental processes.
Oral presentation

**New interpretation of the palate of pterosaurs**

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Based on a new, three dimensionally preserved specimen of the Early Jurassic pterosaur, *Dorygnathus banthensis* we provide a new interpretation of the palate of pterosaurs. Rostral and palatal elements of this exceptionally preserved specimen helped to clarify its palate construction and revealed some unknown parts of the rostral cavity.

One of our main conclusions in contrast to the generally accepted and recently used models is that the hard palate is formed by the extensive palatal plate of the maxilla and not by the palatine. This palatal plate of the maxilla marginates the choana anteriorly–anterolaterally similarly to that of other archosaurs and lepidosaurs. Preserved as an isolated bone in *Dorygnathus*, the anteroposteriorly elongated and flat palatine is in vivo positioned posterior to the palatal plate of the maxilla showing morphological and positional similarities to that of crocodylians and birds, respectively. It separates the medially positioned choana from the suborbital fenestra laterally thus revealing the homologous nature of the (primary) choana in pterosaurs, all other archosaurs and lepidosaurs. Our study indicated that in *Dorygnathus* and in other basal pterosaurs an additional fenestra (pterygo–ectopterygoid fenestra) existed posterior to the suborbital fenestra that became confluent with the adductor chamber in the Pterodactyloidea thus highly increasing the relative size of the adductor chamber and most probably the mass of cranial adductor muscles responsible for jaw closure.

Comparative study of palatally exposed pterosaur specimens indicated that whereas in basal forms the choana was relatively small compared to the interpterygoid vacuity, in more derived members of the group along with the anterior inclination of the quadrates the interpterygoid vacuity became strongly reduced whereas the choana increased in size. This exceptional fossil of *Dorygnathus* also shows a still unknown pair of fenestrae posterior to the incisive foramen which is situated at the palatal contact of the premaxilla–maxilla and might have served as the opening for the vomeronasal organ.
Poster presentation

Life and Death of the Torres del Paine Ichthyosaurs, Southern Chile

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The ichthyosaurs from the Torres del Paine National Park from the area of the Tyndall Glacier represent the southernmost extent of Ichthyosauria to present knowledge (Shultz et al. 2003). A preliminary dating (Stinnesbeck et al. in prep.) indicates Hauterivian or Barremian age for the radiolaritic mud- and sandstone turbidites, which settled at a water depth of 1000 m or more at the mouth of a submarine canyon cutting into the continental shelf. Wood, partially encrusted, and plant debris indicate a close shoreline, probably combined with a river that formed the canyon. In addition to ichthyosaurs there are remains of ganoid and teleost fishes. Ammonites are frequent, belemnites abundant. There are about 34 articulated and virtually complete specimens ranging in size from less than one metre to about five metres; fragmentary skeletons and isolated bones also occur. The specimens were exposed during the retreat of the Tyndall glacier. We identified at least five ichthosaur mortality events, represented by layers with several skeletons. To date all ichthyosaur specimens are identified as Ophthalmosauridae respresented by Platypterygius v. Huene, 1922, and cf. Caypullisaurus Fernandez, 1997. From the taphonomy, abundance and distribution of the ichthyosaur specimens we conclude, that the animals hunted along the shelf above the abyss. Their potential prey, belemnites and small fishes, lived there in abundance. They hunted in swarms consisting of different size classes from early juveniles to fully adults. Occasionally, triggered by earthquakes or sediment overload, turbidite streams burst into the canyon, draging behind them a wave of underpressure pulling down necton trapped in there including the ichthyosaurs. In the mud flow, the animals must have left orientation, drowned and were immediately buried. The predominance of Ophthalmosauridae could be a bias of their ecology or habitat preference.

References
Poster presentation

A small pleurosternid turtle from the Upper Jurassic of Santa Rita (Torres Vedras, Portugal): Juvenile or new form?

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Pleurosternidae are turtles known from the Upper Jurassic to the Palaeocene of Western Europe and North America. In Europe, these turtles are abundant in the English Purbeck. The most common species is Pleurosternon bullockii, but Pleurosternon portlandicum and “Glyptops” typocardium are also represented. Other smaller forms have been interpreted both as juveniles specimens of P. bullockii or as representatives of a new genus of small pleurosternid.

The rest of the Mesozoic European record is scarce. Pleurosternon and Desmemys bertelsmanni have been described from the Lower Cretaceous of Germany. Pleurosternon has also been documented in several Upper Jurassic French and Spanish localities and other indeterminate pleurosternids have been reported from the Upper Jurassic of Portugal and in the Lower Cretaceous of Spain.

A new specimen of pleurosternid turtle, preserving the whole plastron, has been recently found in the Upper Jurassic of Santa Rita (Torres Vedras, Portugal). The decoration of the outer surface is similar to that of Pleurosternon: smooth and shiny, with regular and clearly defined pits, and with fine striations perpendicular to the margins of the plates. The specimen shared with Pleurosternon bullockii the combination of a wider than long entoplastron and an intergular shield with five straight edges. However, the specimen has many differences with Pleurosternon: the plastral posterior lobe is more rounded and is not notched, the contact of the scutes on the sagittal plane is winding and has a different disposition of the inframarginal scutes on the plates of the plastron. On the other hand, the Santa Rita turtle is small, less than half of the size of the P. bullockii adults specimens, but presents two characters (the intergular covering the entoplastron and the absence of fontanelles) that allow to consider it as an adult individual.

In conclusion, the available information indicates that the Portuguese specimen is a member of a new pleurosternid taxon, probably closely related to some of the Dorset small individuals.
Oral presentation

**Wing extension in pterosaurs: new models**

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All powered flying animals have to face the same energetic problems: operating the wings during steady flight with muscles that require constant energy input and neural control to work. To overcome these arising problems the extant flying vertebrates have found in principle the same solution - the biomechanical automatism built in their skeletal, muscular and connective tissue system. The first vertebrates known to evolve powered flight are the extinct group of pterosaurs. The extension of the elongate fourth finger (distal wing), which solely supported their extensive flight membrane, must have been one of their major energetic problems: being a long lever arm, the wing finger must have experienced significant loads in form of forces that acted to flex it during steady flight. The reduction of body mass, especially muscle mass in the distal wing through biomechanical automatism similar to those of extant fliers would have been strongly beneficial for pterosaurs, some later forms of which have reached extremely large sizes. Based on birds and bats as extant analogues, two new models are presented here for the mechanism of the distal wing extension in pterosaurs. In the first model we hypothesize the presence of a propatagial ligament or ligamentous system which, as a result of the elbow extension, automatically performs and maintains the extension of the wing finger during flight and prohibits the hyperextension of the elbow. The second model has a co-operating bird-like propatagial ligamentous system and bat-like tendinous extensor muscle system on the forearm of the hypothetical pterosaur. Both models provide strong benefits to an animal with powered flight: 1. reduction of muscles and weight in the distal wing, 2. prevention of hyper extension of the elbow against drag, 3. automating wing extension and thereby reducing metabolic costs required to operate the pterosaurian locomotor apparatus. These models, although hypothetical, fit with the existing fossil evidence and lay down a basis for further biomechanical and/or aerodynamical investigations.
Fossil evidence of at least one of these groups in the Central-European region dates back as early as the Middle Triassic: some turtle shell fragments have been documented from the Anisian Pestis Formation of Romania and were tentatively referred to Proganochelys. The Jurassic only yielded thalattosuchian marine crocodilians best exemplified by an undescribed incomplete skeleton with only a few skull elements from the Toarcian ammonitico rosso type limestone of the Gerecse Mountains, Hungary. The large size, the unsulptured mandibular elements and the presence of well developed, keeled osteoderms suggest affinities with Steneosaurus for this taxon.

The Late Cretaceous turtle assemblage of Romania until recently has only been consisted of the selmacryptodiran Kallokibotion from the Maastrichtian Hațeg Basin but shell fragments of pleurodires have been also discovered from the same horizon and were assigned to the families Dortokidae and Bothremydidae. The same pleurodiran groups also occur in the Santonian Csehbánya Formation of Hungary: one of them is represented by excellent cranial material belonging to an unnamed new bothremydid closely related to Foxemys. The other pleurodride is much less abundant, more fragmentary and according to the microreticular decoration of the shell it is also closely related to Dortokidae. The enigmatic Senonemys was described on the basis of an internal mold of a carapax from the Campanian marine Ugod Limestone Formation and is here considered as invalid because of the lack of any diagnostic characters. Similarly the material of „Emys neumayri” from the Campanian Gosau Formation of Austria is insufficient to differentiate a genus. Considering the microreticular decoration and the sutured plastron to the first costal it can be also tentatively referred to Dortokidae.

Basal mesoeucrocdylians are in part represented by a ziphodont form, Doratodon from the Late Cretaceous of Austria, Hungary and Romania which is based on the revision of the type material and the study of new material from the Csehbánya Formation can be considered as a primitive sebecosuchian. Besides a fragmentary ziphosuchian from the Hațeg Basin cranial remains of a new taxon have been recently discovered which shows affinities with the Gondwana Araripesuchus. A basal eusuchian, Allodaposuchus has been also described from the same basin. Iharkutosuchus is another basal eusuchian with strongly heterodont dentition from the Csehbánya Formation showing more derived cranial characters than the basal most Isisfordia. Mandibular remains of a derived eusuchian are also known to occur in this formation which is probably related to primitive globidontan alligatoroids. From the Gosau Formation some isolated, alligatoroid-like crushing teeth and a small dentary with possibly confluent 3rd and 4th alveoli can be identified. Recently, isolated teeth of the primitive globidontan Acynodon have been reported from the Hațeg Basin.
Oral presentation

**Isolated theropod teeth from the Kem Kem Beds (Early Cenomanian) near Taouz, Morocco**

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Morphometric data of 37 well preserved isolated theropod teeth from the Early Cenomanian Kem Kem beds, Morocco are acquired according to the method of Smith et al. (2005). Most of the teeth were collected in 1971 by H. Alberti and his co-workers O. Cherif and U. George near the town of Taouz at the Hammada du Guir and are housed in the palaeontological collection of the Museum des Geowissenschaftlichen Zentrums der Georg-August-Universität Göttingen, Germany. Direct comparison reveals that four different morphotypes (MT 1-4) are present in the material. The teeth of MT 1 show no serrations of the carina and therefore belong to spinosaurid dinosaurs. The teeth of MT 2-4 have serrated carinae and our data analysis indicates that they refer to the groups of dromaeosaurid, abelisaurid and carcharodontosaurid dinosaurs.

Three types of crown enamel ornamentation are present among the teeth of MT 1, which implies that apart from *Spinosaurus aegyptiacus* STROMER 1915 more than one spinosaurid species may be present in the Early Cenomanian of Northern Africa. Our results propose the presence of abelisaurids and confirm the occurrence of dromaeosaurids and carcharodontosaurids in Morocco (Amiot et al. 2004). The theropod dinosaur fauna in the Cretaceous of Northern Africa was more diverse than hitherto expected.

References:

The first specimens of the Devonian tetrapod *Ichthyostega* were found on the Danish Three-Year Expedition to East Greenland 1931-1934 under the leadership of the Danish geologist Lauge Koch. Being the earliest known four-legged animal known at the time, the creature was immediately dubbed 'the four-legged fish' and launched into public space as a 'missing link', from the time when vertebrate life first ventured onto dry land from the sea. Over the following decades, the popular scientific icon of 'the four-legged fish' served as a vessel not only for scientific interest, but also for international and institutional rivalry and the personal ambition of individual scientists.

This paper traces the fate and tracks of the Devonian tetrapod *Ichthyostega* as it traversed, bridged and blurred the division between 'popular imagination' and 'scientific knowledge' between 1931 and 1955. For it is a striking fact, that while during this period palaeontologists deliberated on the form and status of *Ichthyostega* in the history of evolution, the image of a 'four-legged fish' settled in the public imagination to such a degree, that it shaped scientific lore about the animal until the late 1990's.
Between 1913 and 1916, the Danish artist and graphic designer Gerhard Heilmann published a series of articles in the journal of the Danish Ornithological Society. From the outset Heilmann’s work aroused international interest, and in 1926 it was published in English as a book entitled *The Origin of Birds*. The book set the international agenda for discussions of bird evolution for the next 40 years. In Denmark however, Heilmann’s highly original work was generally ignored or even ridiculed by zoologists.

This paper presents an account of those factors and events that allowed Heilmann to complete the transformation from absolute amateur to international authority on the intricate issue of bird evolution and bird-dinosaur relationships. It demonstrates how Heilmann’s artistic abilities played an important role in this, while at the same time his troublesome personality and lack of scientific credentials led to his complete isolation within the Danish scientific community. More particularly, Heilmann’s work is shown to have developed alongside and in connection to another classic work: *On Growth and Form* (1917) by the Scottish zoologist D’Arcy Wentworth Thompson.
Oral presentation

**Identifying fossil habitats using ungulate long bones**

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The presented method allows habitat determination based on measurements of ungulate long bones. Different sections of the limb bones (front limb: humerus, radius, metacarpus; hind limb: femur, tibia, metatarsus) of extant artiodactyls and perissodactyls were measured and statistically analyzed by means of factor analysis. The data of recent bovids are useful to distinguish the preferred habitat like grassland, forest, and mountainous region. Because of the preservation of the fossil material the method had to be modified. Specimens with all six long bones belonging to one individual are very rare and often not as well-preserved as they have to be for an adequate measuring. Therefore only metapodials (metacarpus, metatarsus) are examined to determine the paleohabitat. At least the habitats grassland and forest can be distinguished for fossil bovids. Bovids living in grassland habitats share adaptational features with extant and fossil equids.
Oral presentation

On the origin of the Metoposauridae (Amphibia, Temnospondyli)

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Among the Late Triassic temnospondyls, the Metoposauridae comprises a conservative group with obscure origin. Speculations on its ancestry are heavily dependent on the idea of principal bauplans to be discerned among the temnospondyls and on the assessment of interrelationships of their advanced lineages. Recent views on the systematics of Triassic temnospondyls are dominated by the belief that nearly all of them belong to a "stereospondyl" clade derived from the rhinesuchid-related ancestors. Within this unit, the metoposaurs are usually considered as the trematosauroid derivatives (Milner 1990, Schoch, Milner, 2000; Yates, Warren, 2000; Damiani, Yates, 2003; Ruta et al. 2007). The grounds behind this idea are extremely vague and primarily focused on shared characters which are still lacking in primitive trematosauroids, such as postorbital elongation of skull roof and wide interorbital distance.

An alternative hypothesis presumes that the metoposaurid cranial pattern was inherited from the Permian trimerorhachoids (Säve-Söderbergh, 1935, Shishkin, 1967). For testing it, of additional importance is the morphology of short-headed trimerorhachoid offshoots, recently referred to as the "dvinosaurians" (eobrachyopids, dvinosaurids, tupilakosaurids and the forms conventionally termed here the Laurasian brachyopoids). The same holds for the typical Gondwanan brachyopids, since the attempts to broadly separate them from the "dvinosaurians", in contrast to traditional viewpoint (Yates, Warren, 2000), found no support (cf. Damiani, Kitching, 2003). Altogether, these affinities can suggest the concept of the vast trimerorhachoid radiation, in which the metoposaurs were the latest survivors. This strictly aquatic radiation is presumed to combine primitive short-faced skull roof pattern with a number of early arisen advanced characters of cheek (squamosal-tabular suture) and palatal design (Shishkin, 1973).

Apart from well known similarities in the skull pattern and the atlas-axis structure, the above concept is primarily supported by the following facts. (1) Both Trimerorhachis and metoposaurs have an unque, basically L-shaped exoccipital with anterior notch for enormously expanded jugular passage. Similar large notch (rather than jugular foramen) occurs as a common variation in brachyopids (Shishkin, 1991) and is recapitulated at the early growth stages in brachyopoid Batrachosuchoides (Shishkin, Sulej, in press). (2) The postorbital-parietal contact, known in a number of "dvinosaurians", but otherwise unique for temnospondyls, has been found in Metoposaurus as a fairly common variation (Sulej, 2007). (3) An expansion of the symphyseal tusk bases toward the dentary labial margin, with reduction of adjacent marginal teeth, is a routine variation both in metoposaurs (Konietzko-Meier, Wawro, 2007) and Batrachosuchoides. The above-listed characters have no parallels in the trematosauroid morphology.
Oral presentation

**On the Late Paleocene fish family Asianthidae (Acanthopterygii, Percoidei)**

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Among the earliest marine percoids known hitherto the best recorded group is the family Asianthidae from the Late Paleocene of Turkmenia (Sytchevskaya and Prokofiev, 2003). It includes the three genera (*Asianthus*, *Eosasia*, *Pauranthus*) and is characterized by specific spinules on the posterior side of dorsal, anal and pelvic fin rays.

The grounds for distinguishing the Asianthidae were questioned by Bannikov and Carnevale (2007), based on study of *Asianthus* ("*Serranus*”) *celebratus* and some unspecified “generalized Late Paleocene percoids”. These authors reject the importance of family’s key characters and regard it as “not valid”, thus clearly confusing the point of their criticism with (non-existing) violations of the rules the International Code of Zoological Nomenclature for the erection of the familial-rank taxa. In a whole, the analysis of Bannikov and Carnevale’s arguments and our re-examination of the type material result in the following conclusions.

I. (a) The presence of the spinules on the pelvic, dorsal and anal fin rays (denied by the above authors) was confirmed for all the asianthids. (b) It was shown that, by their arrangement and by the very set of the spinulae-bearing rays, the asianthids differ from other percoids, such as the Priacanthidae and Caproidae. (c) Bannikov and Carnevale’s statement that the spinulae may be diagnostic the greatest at the generic level is arbitrary and at variance with their own data on the condition in the Priacanthidae.

II. The presence of the spinoid scale sheath of the second type according to Roberts’ scheme, formerly detected in *Asianthus* (and initially attributed to the first type) is now confirmed for the all asianthid taxa. Bannikov and Carnevale’s failure to recognize this condition was most probably caused by sparsity or lack of specimens with externally exposed scales.

III. As was formerly demonstrated, in *Asianthus* and *Pauranthus* the first two dorsal-fin spines are associated with a single complex pterygiophore, while in *Eosasia* each has its separate pterygiophore. Bannikov and Carnevale’s evaluation of this difference as an individual variation is just a declaration. With respect to *Asianthus*, it was not supported by any specific evidence, while the other asianthids were not examined by the above authors. What they believe to be an indirect evidence relates to quite another group (Gerriidae) and another fin (anal rather then dorsal). Besides, the two gerriid specimens they present as an example of variation show marked differences in the skeletal design, which makes their conspecificity much doubtful.

Hence, the analysis made by Bannikov and Carnevale actually contains no arguments that could undermine distinguishing the family Asianthidae.

References:


Excavations conducted by the Museum of Natural History of Aix-en-Provence, funded by the Escota Company, revealed ten new dinosaur localities in the course of the works done to open new lanes along the A8 highway east of the city of Aix en Provence. From February 2006 to June 2007, seven excavated sites in the Arc Basin (Early Campanian – Early Maastrichtian) proved very rich in vertebrate remains.

These sites fall into two categories:
- Lacustrine levels (Early Campanian) which yielded various remains of turtles (Polysternon), crocodiles, sharks, lepisosteids, nodosaur and squamate teeth and molluscs.
- Sandstone levels (Late Campanian – Early Maastrichtian) corresponding to channel deposits which yielded remains of crocodiles (Musturzabalsuchus, Ischyrochampsa), turtles (Foxemys, Solemys), various dinosaurs (including Rhobdodon, nodosaurids, titanosaurids, dromaeosaurids and abelisaurids), pterosaurs and mammals.

Among the most important discoveries are pterosaur bones (quadrate, humerus), a fragmentary dentary of a mammal, an abelisaurid braincase and postcranial elements, and associated titanosaurid remains including a series of dorsal vertebrae. The abelisaurid material, consisting of a braincase, a squamosal, a tibia, a fibula and an anterior caudal vertebra, is the most complete to date in Europe and belongs to a new genus.

These diverse vertebrate assemblages, still under study, will allow us to know more about the diversity and succession of vertebrate faunas in Provence, and more generally in southern France, at the end of the Cretaceous and should provide important new evidence about their relationships with other European or Gondwanan faunas.
The Tertiary fossil record of swifts is among the largest among the smaller birds and includes species from Germany, France, UK, and Denmark. In the early Tertiary, both modern taxa, Apodidae (typical swifts) and Hemiprocnidae (tree swifts), already exist as well as the fossil Aegialornithidae. Most Tertiary swifts consist of rather well preserved humeri, whereas the the Eocene Messel pit (Germany) yielded nearly complete skeletons.

The Lower Eocene Green River Formation (USA) yielded a fairly large number of bird species, including a swift. The specimen is nearly complete, but rather crushed, which complicates comparisons with the majority of fossil swifts. Nevertheless, it clearly represents a new species which is characterized by a short, stout humerus with processus musculi extensor metacarpi radialis in the distal third of the humerus, a humerus with a narrow head, and a coracoid with long, but slender processus procoracoideus. The Green River species seems to be slightly more plesiomorphic than *Scaniacypselus* from Messel, which is to be expected considering its slightly higher age. Based on the similarities to *Scaniacypselus* and modern Apodidae particularly in the wing bones, I tentatively refer the new species to the Apodidae. It probably represents a sister-taxon to the taxon (*Scaniacypselus* + modern Apodidae), since *Scaniacypselus* is more derived in its wing proportions. To solve the precise relationships of the early Tertiary swifts, better preserved and more complete specimens are necessary.
Oral presentation

**New early Late Jurassic vertebrate localities near Shanshan in the Turpan Basin (NW China) – a field report**

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Since 2007, three expeditions of the Sino-German Paleontological Cooperation Project have prospected for Middle and Late Jurassic vertebrate assemblages in fluvial-lacustrine sediments near the town of Shanshan in Xinjiang Autonomous Province, China. The most recent expedition in April of 2009 focused on the early Late Jurassic Qigu Formation, which is particularly rich in macroscopic vertebrate fossils. Fieldwork included quarrying blocks from an immense accumulation of fossil turtles at the so-called “Mesa Chelonia” site and prospecting for and excavating of dinosaur material.

The Mesa Chelonia site consists of a 10 – 20 cm thick mudstone layer which dips at ca. 60° to the north and is exposed both on the west and east sides of a mesa capped by Pleistocene alluvial deposits. All skeletal elements of at least two xinjiangchelyid taxa, currently assigned to *Annemys cf. latiens* and *Xinjiangchelys cf. chowi*, are present. The total number of turtles once buried in an originally 500 m² large area is calculated at about 2500, likely representing the world’s richest fossil turtle taphocoenosis (death assemblage).

The articulated bones of a gigantic sauropod with a 4.2 m long series of 13 anterior caudal vertebrae, several ribs, and an articulated left hind limb are among the new dinosaur finds. Fifteen isolated gastroliths were found next to the femur. Four additional, promising sauropod localities, which yield long bones, articulated cervical vertebrae, the articulated dorsal vertebrae of a juvenile individual, and articulated phalanges, were identified and await further investigation. Among isolated dinosaur bones found in the area are a partially preserved metatarsal III of a large theropod, several small theropod teeth, the distal half of a maniraptoran femur, and the fragment of an ilium tentatively referred to Stegosauria.
The Rüdersdorf Muschelkalk Quarry

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The Muschelkalk Quarry in Rüdersdorf is situated about 25 km east of the centre of Berlin (N 52°28'40", E 13°47'12") and represents the most significant geological and palaeontological quarry in the larger Berlin area. Natural exposures of Mesozoic sediments are very rare in the states of Berlin and Brandenburg, due to glacial abrasion and subsequent deposition of glacial till during the Pleistocene.

The Rüdersdorf Muschelkalk lies at the northern flank of an anticline formed by salt tectonics and is positioned on the western border of the Northern German-Polish Salt Diapir Basin, which spans from the North Sea to the Polish mountain ranges. Here, an accumulation of more than 2500 m of salt in the underlying Permian Zechstein sediments caused an uplift of overlying sediments up to the erosional surface level. The strata around Rüdersdorf are part of such a dome and all sediment in the quarry shallowly dip with 15-20° to the north. The complete structure is divided in two parts by a large fault with an offset of 200-300 m. The remaining joints and faults are arranged in a radial pattern and are often infilled with interesting minerals, such as the coelestin deposits within the Wellenkalk.

The Rüdersdorf locality is of special economic importance because it is the northernmost deposit of Muschelkalk limestone in Eastern Germany and because of its vicinity to Berlin. Quarrying of limestone began as early as the 13th century and today the company Rüdersdorfer Zement GmbH is one of the largest cement producers in central Europe. The impressive quarry now includes an area that is about 4 km long, 1 km wide, and 60 m below the groundwater table. Rock is quarried from three 30 m cliffs. The century-long quarrying has exposed a Triassic profile (Fig. 1) ranging from the Upper Buntsandstein (Pelitröt-Folge) up to the Upper Muschelkalk (Hauptmuschelkalk-Folge).

The Middle Triassic Muschelkalk (literally: shell limestone) Group is lithostratigraphically divided in Germany into three subgroups, Lower, Middle and Upper Muschelkalk, which comprise of several regional formations each, most of which are restricted to Southern Germany. The Lower Muschelkalk, sometimes called Wellenkalk (literally: wave limestone), is divided into five lithostratigraphic formations...
and consists mainly of limestone, calcareous marls, and clayey marls. Some beds are composed of porous cellular limestone (*Schaumkalk*, literally: foam limestone), which were formed by dissolution of ooids. The Middle Muschelkalk is divided in five formations which typically consist of evaporites (gypsum, anhydrite and halite). The Upper Muschelkalk (Hauptmuschelkalk) is divided into nine formations. It is more similar to the Lower Muschelkalk and consists of regular beds of shelly limestones, marls and dolostones. The lower portion (*Trochitenkalk*) is often composed entirely of fragmentary stems of the crinoid *Encrinus liliiformis*; younger beds commonly yield ceratites.

In the Rüdersdorf Quarry, the contacts of the Lower Muschelkalk with the Bundsandstein below and the Middle Muschelkalk above have been determined on the basis of technical criteria instead of internationally used geological features. The exposed Muschelkalk section is geochemically divided into "quality horizons" A to T (Fig. 2), mainly on the basis of differing carbonate contents. Quality horizons R, S and T are currently not exposed in the quarry. The Wellenkalk, a marly limestone, is used for cement production, the Schaumkalk, a clean limestone, is used for quick lime production. The magnesium-rich Middle Muschelkalk marls are used as fertilizer in agriculture.

![Stratigraphic profile and fossil content of strata exposed in Rüdersdorf Quarry. Modified from Streichan (1990).](image-url)
While the spectrum of fossils found in Rüdersdorf is generally similar to other Muschelkalk localities, there are some distinctive features. The special palaeogeographical position near the Southeast-European Faunal Passageway during the Lower Muschelkalk and the shallow exposure of the Rüdersdorf area with other nearby shelf areas resulted in rapidly changing ecological conditions and varying fossil preservation. Two stratigraphic units within the profile are especially rich in well-preserved fossils: 1. the transition of the Myophorien-Folge to the Wellenkalk-Folge (Horizons A and B9) and 2. the upper 40 m of the Schaumkalk (Horizons I and K).

The Upper Muschelkalk is very rich in invertebrate fossils, such as cephalopods (ceratites, nautilids), bivalves, brachiopods, gastropods, and echinoderms (crinoids, ophiuroids, echinoids). Vertebrate remains are comparatively rare, but may be found with some luck, for example in the basalmost layer of Horizon A.

Isolated teeth, fin rays, and scales of fishes are the most common vertebrate fossils in the Muschelkalk. The German Triassic Basin has preserved a unique association of fossil fishes, which is generally depauperated in genera and species relative to surrounding oceans. This is also demonstrated by the fossil fishes from Rüdersdorf. Fossil selachians are known only by isolated remains, especially the teeth of the small hybodontid sharks *Hybodus*, *Acrodus*, and *Palaeobates*. Actinopterygians are represented mainly by remains of archaic taxa from the Palaeozoic, such as the conical teeth of the predatory *Saurichthys* and *Birgeria*. However, rounded teeth of the durophageous taxon *Colobodus* demonstrate also the presence of more advanced neopterygians in Rüdersdorf. The most common scales are the diagonally grooved ganoid scales of *Gyrolepis*. Fossil reptiles are mostly represented by commonly abraded isolated teeth and bones of sauropterygians. The most common sauropterygian fossils are the slender, slightly curved, and strongly grooved teeth of *Nothosaurus* and the black and rounded durophageous teeth of *Placodus*. Placodontians were common elements of the German Muschelkalk and fed on the rich shellfish fauna of the Muschelkalk-ocean. Nothosaur remains are even more common in Muschelkalk deposits and are regarded as index fossils, but they are mostly represented by isolated bones. Hence, the find of a complete skeleton of *Nothosaurus marchicus* in Rüdersdorf is of special significance. The specimen is now on display at the Museum für Naturkunde Berlin.

In addition to its significance as a Triassic Muschelkalk exposure, the Rüdersdorf Quarry is also of historical importance for glaciology. In the year 1875, Otto Torell discovered grooves on limestone surfaces, which he correctly interpreted as glacial striations. This was the final proof of that Scandinavian glaciation once extended south of the Baltic Sea.

Please note that the complete quarry area of Rüdersdorf must only be entered with permission of the general management. Permission is given to guided groups only.

Further reading:
Field trip guide; July 24, 2009; Stop 2:

**The Rixdorf Horizon („Rixdorfer Horizont”) of the Niederlehme sand pits near Königs Wusterhausen**

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Fossil mammals from the ice age have been found in Berlin and the former Margraviate of Brandenburg since the 18th century and many important finds were reported during the second half of the 19th and the 20th century. In the region, mammal bones are rare in interglacial strata, but frequent in glacial sediments, such as gravel, gravel-sand, and sand deposits. The best example for a glacial mammal deposit is the so called Rixdorf Horizon ("Rixdorfer Horizont"), a glaciofluvial gravel-sand layer, which yields one of the most important Pleistocene mammal assemblages from the northern Middle European lowland. The Rixdorf Horizon is characterised by an accumulation of bones in melt water deposits, typically over- and underlain by glacial drift sediments and exposed at several localities. The classic localities of the Rixdorf Horizon in Berlin (e.g., Rixdorf, Tempelhof) are overbuilt and cannot be accessed. The sand pit Niederlehme near Königs Wusterhausen is still in use today, displays a fully exposed Pleistocene profile, and represents the most important locality of the Rixdorf Horizon. Skeletal remains of Rixdorf mammals are deposited in various museums in the states of Berlin and Brandenburg.

Localities of the Rixdorf Horizon are located in a NW/SE oriented strip within younger moraines dated as part of the Brandenburg Stade within the Weichselian Glacial. The strip is bounded to the south by the border of the Brandenburg maximum ice advance, which marks the maximum extension of the Weichselian inland glaciers, and to the north by the ice margin of the Frankfurt Stade. The locality Niederlehme is positioned on one of several plateau islands in the south of the Berlin glacial valley (Berliner Urstromtal). The area is mostly covered by Weichselian and Holocene sediments, which are underlain by older Pleistocene sediments. The plateau islands are surrounded by valley sands to the north and south, and bounded by gullies of the river system Dahme to the east and west. The Niederlehme plateau island consists of glacial till, gravel sands, sands and silt, and its southern and western part with the locality Niederlehme was interpreted as a dislocated moraine (Keilhack 1921), part of the Weichselian maximum ice advance (Behrmann 1950), or as a glacial kame terrace (Dietrich 1932).

There are two sand pits in Niederlehme, both of which have produced fossil mammals. They are situated about 3 km northeast of the town of Königs Wusterhausen, North (N 52°19′30″, E 13°40′45″) and South (N 52°18′40″, E 13°40′28″) of highway A10. The following description of the sequence is based on the profile in the sand pit Niederlehme North of the highway. It has been active since the 1870s and was expanded during the construction boom in Berlin at the end of the 19th century. In the sand pit, an approximately 25 m thick Pleistocene succession of sediments is exposed (Dietrich 1932, Cepek 1986, Heinrich 2002), comprising the following lithostratigraphic units (Fig. 1): The underlying stratum is formed by a dark- to olive brownish Lower Till ("unterer Geschiebemergel"), which reaches a thickness of up to 8 m. This Lower Till was deposited during the Saale glacial (Hermdorf 2000). On top of the Lower Till a strongly lithified layer is often found, the so-called “Steinsohle”, which was formed by glaciofluvial leaching. On top of the Steinsohle 1-2 m of thick Rocky Gravel Sands (“steinige Kiessande”) follow, which are exposed at the quarry floor. The Rocky Gravel Sands form the Rixdorf Horizon in a narrower sense, they are the primary strata that yield mammal remains at Niederlehme, but they also contain re-deposited shells of *Viviparus diluvianus* and clay clasts that have been washed into the strata as frozen particles. Recently, a fluvial channel with fossils and a frost wedge were discovered, indicating a short interruption of the sedimentation under glacial conditions.
The Rocky Gravel Sands were deposited during the peak of the Weichselian glacial and are estimated to have an age of 27000 – 30000 years (Hermsdorf 2002). They are overlain by an up to 20 m thick Sequence of Sands (Abfolge von Sanden) which is lithified at its base and mostly consists of fine-grained, partially cross-bedded sand. Mammal remains are extraordinarily rare in the Sequence of Sands. The sands were deposited by running melt water, and the decrease in grain sizes from the base to the top and the northwestern flow direction indicate glaciofluvial de-watering in the retraction phase of the glaciation. The top of the profile is formed by the Upper Till (“oberer Geschiebemergel”), which reaches a thickness of up to 2 m and is followed by a periglacial cover. The Upper Till is interpreted as a ground moraine of the Weichselian Glacial (Brandenburg Stade) and was formed during the main expansion of the Weichselian glaciers about 20000 years ago.

In the Rocky Gravel Sands, mammals are represented exclusively by isolated bones, teeth and antler fragments. The fossils can sometimes be found in cluster-like accumulations. Well-preserved bones and teeth are rare, and most remnants are broken or eroded with abrasion marks. Some long bones (e.g., *Coelodonta antiquitatis*) show bite marks. The bones are mostly of a light- to middle brown colour, showing manganese-dendritic mottling as well as patches of differing brownish colours that were produced by redeposited lignites within gravel sands (“Rixdorf preservation”).

For a long time, the Rixdorf Horizon yielded only big mammals. Tusks and molars of *Mammuthus primigenius* (woolly mammoth) were already reported by Berendt in 1882. Other examples include molars of *Coelodonta antiquitatis* (woolly rhinoceros), jaw remains of *Canis lupus* (grey wolf), and antler remains of *Rangifer tarandus* (reindeer) and *Megaloceros giganteus* (giant deer). Rare, isolated finds are known of the smaller *Castor fiber* (beaver) and *Alopex lagopus* (Arctic fox), and tiny molars of *Lemmus lemmus* (Norwegian lemming) were reported recently as well (Hermsdorf 2000). The most frequent finds include *Equus* sp. cf. *germanicus* (German wild horse), followed by *Mammuthus primigenius*, *Bison priscus* (steppe bison), and *Coelodonta antiquitatis* (Fig. 2). Rarer finds include *Rangifer tarandus* (reindeer), *Megaloceros giganteus* (giant deer) and *Cervus elaphus* (red deer). There may have been a collecting bias in the past, when only the most attractive fossil bits were saved. All in all, the fauna of the Rixdorf Horizon currently lists 26 mammal species.
Fig. 2. Frequency distribution of fossil mammals in the Rocky Gravel Sands, Rixdorf Horizon at the Niederlehme sand pits. 1 – wolverine (Gulo gulo); 2 – leopard (Panthera pardus); 3 – cave hyena (Crocuta crocuta spelaea); 4 – Arctic fox (Alopex lagopus); 5 – cave bear/brown bear (Ursus spelaeus/arctos); 6 – Norwegian lemming (Lemmus lemmus); 7 – vole (Microtus sp.); 8 – musk ox (Ovibos moschatus); 9 – European beaver (Castor fiber); 10 – wild ass (Hemionus hemionus); 11 – collared lemming (Dicrostonyx sp.); 12 – gray wolf (Canis lupus); 13 – elk (Alces alces); 14 – forest rhino (Stephanorhinus kirchbergensis); 15 – cave lion (Panthera leo spelaea); 16 – fallow deer (Dama dama); 17 – reindeer (Rangifer tarandus); 18 – giant deer (Megaloceros giganteus); 19 – red deer (Cervus elaphus); 20 – woolly rhinoceros (Coelodonta antiquitatis); 21 – steppe bison (Bison priscus); 22 – woolly mammoth (Mammuthus primigenius); wild horse (Equus sp. cf. germanicus). Modified from Heinrich (2002).

The sand pit at Niederlehme represents the richest mammal taxon assemblage from the Rixdorf Horizon, and therefore is considered to be more representative for these strata than other localities. The known fossil mammal taxa are interpreted as primary and secondary allochthonous skeletal remains. The former were re-deposited but are geologically from the same age as the Rixdorf Horizon itself. The latter are skeletal remains from older strata such as interglacial sediments, which were re-bedded in the Rixdorf Horizon and are not authentic elements of the Rixdorf fauna. These are sometimes deciduous and mixed forest inhabitants, which occurred in middle Europe only during interglacials: Elephas antiquus (straight-tusked elephant), Stephanorhinus kirchbergensis (forest rhino), and Dama dama (fallow deer). By far more frequent are inhabitants of the steppe and tundra, which existed in the area only during glacial times and are represented for example by Equus hemionus (Asian wild ass), Ovibos moschatus (musk ox), Rangifer tarandus (reindeer) and Alopex lagopus (arctic fox). Finally there are also mammals that inhabited the area during glacial and interglacial times, such as Canis lupus (grey wolf), Megaloceros giganteus (giant deer) and Panthera leo spelaea (cave lion). The demands of these mammals from their environment are very different, so that they cannot have existed synchronously. Thus, Niederlehme most likely represents a heterochronous faunal mix, similar to all other localities of the Rixdorf Horizon.
References:


