Zitteliana

An International Journal
of Palaeontology and Geobiology

Series B /Reihe B
Abhandlung der Bayerischen Staatssammlung
für Paläontologie und Geologie

29

Paläontologie im Blickpunkt

80. Jahrestagung der Paläontologischen Gesellschaft
5.–8. Oktober 2010

Programm und Kurzfassungen – Program and Abstracts

München 2010

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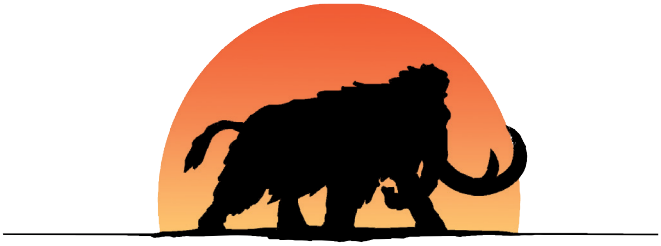

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Paläontologie & Geobiologie LMU München

Bayerische Staatssammlung für Paläontologie und Geologie

GeoBio-Center LMU München

München 2010

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CONTENTS/INHALT

Zitteliana	B 29	118 Seiten	München, 1.10.2010	ISSN 1612-4138

Einführung

Die 80. Jahrestagung der Paläontologischen Gesellschaft steht unter dem Motto „Paläontologie im Blickpunkt". Die Ergebnisse paläontologischer Forschung gewinnen zurzeit stark an Bedeutung für die Beantwortung einiger der zentralen Fragen der Menschheit im 21. Jahrhundert. Nur durch den Rückblick in die Erdgeschichte können die Folgen des derzeitigen Verlustes von Biodiversität bis hin zu den lokalen und globalen Auswirkungen des Klimawandels wirklich interpretiert und verstanden werden. Das Fach Paläontologie rückt somit verstärkt ins Zentrum der öffentlichen Wahrnehmung.

Renommierte Keynote-Sprecher und Vortragende aus aller Welt haben zu einem anspruchsvollen und vielfältigen Programm der 80. Jahrestagung der Paläontologischen Gesellschaft beigetragen. Vorträge für 11 Symposien, für "Freie Themen", zahlreiche Poster, ein Öffentlicher Vortrag sowie ein Kompaktkurs, alle aus spannenden und hochaktuellen Forschungsfeldern, wurden angemeldet. Im Blickpunkt stehen aber nicht nur die Paläontologie und ihre Nachbardisziplinen, sondern auch unsere Nachwuchsforscher/innen, denen mit dem "Zukunfts-Symposium" (Zukunftspreis für junge Paläontologen) eine attraktive Plattform geboten wird. Das Zukunfts-Symposium, einmalig für die Jahrestagung der Paläontologischen Gesellschaft, wurde anlässlich der goldenen Doktorjubiläen von Prof. Dr. A. von Hillebrandt (Berlin) und unseres Ehrenmitglieds Prof. Dr. Dr. D. Herm (München) initiiert; das Preisgeld wurde von den beiden Jubilaren gestiftet. Der rege Zuspruch, den es erfahren hat (18 Vorträge!) zeigt das starke Interesse der Jungforscher/innen für unser Fach. Darüber hinaus bieten wir auch viel Zeit für Poster-Sessions und es besteht die Möglichkeit, das "beste Poster" zu wählen. Weiterhin wird auch wieder das Fossil des Jahres gewählt werden. Alle Preisverleihungen finden während des gemeinsamen Abendessens am Freitagabend statt. Wir freuen uns auf viele spannende Beiträge und Diskussionen!

Sponsoren

Für die finanzielle Unterstützung bedanken wir uns bei:

Deutsche Forschungsgemeinschaft (DFG), Bonn

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(Fragile Earth Programm), LMU München

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Tagungsbüro

Ursula Bommhardt, Monika Brinkrolf, Dr. Nora Dotzler, Ella Schönhofer

Studentische Hilfskräfte

Saskia Börner, Stefan Gehring, Christoph Gierl, Nicola Heckeberg, Patrick Kotyla, Stefanie Penk (alle Bc. Sc.)

Veranstalter

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Bayerische Staatssammlung für Paläontologie und Geologie
GeoBio-Center^{LMU}

Tagungsort

Paläontologisches Museum, Richard-Wagner Str. 10, D-80333 München
Department für Geo- u. Umweltwissenschaften der LMU München, Richard-Wagner Str. 10, Luisenstr. 37, D-80333 München

Wissenschaftliches Programm

Das Vortrags- und Poster-Programm umfasst neben den Freien Themen die Symposien A-K mit insgesamt 10 Übersichtsvorträgen, 112 Vorträgen und 81 Poster-Präsentationen sowie den Öffentlichen Abendvortrag (Prof. Dr. J. Thiede, Kopenhagen).

Die Titel und Leiter der Symposien sind:

A. Zukunftspreis für junge Paläontologen. - **B. Reichenbacher**, LMU München, **M. Krings**, BSPG & LMU München, **G. Wörheide**, BSPG & LMU München & GeoBio-Center^{LMU}.

B. Hohe Diversität auf allen Ebenen - warum sind Mollusken so erfolgreich? - **A. Nützel**, BSPG & LMU München, **M. Amler**, LMU München.

C. Fragile Earth - Riffe und Umwelt. - **G. Wörheide**, BSPG & LMU München & GeoBio-Center^{LMU}, **M. Nose**, BSPG.

D. Freie Themen Paläobotanik/Palynologie (APP). - **L. Kunzmann**, Senckenberg Naturhistorische Sammlungen Dresden.

E. Mesozoische Gymnospermen. - **H. Kerp**, Univ. Münster, **L. Kunzmann**, Senckenberg Dresden, **M. Krings**, BSPG & LMU München.

F. Advances in terrestrial vertebrate palaeontology: understanding large-scale processes in the Eurasian Neogene. - **J. Prieto**, BSPG & LMU München & Univ. Tübingen.

G. Mikropaläontologie. - **A.V. Altenbach**, LMU München & GeoBio-Center^{LMU}.

H. Potenzial Molekulare Paläobiologie. - **G. Wörheide**, **G. Rößner**, beide BSPG & LMU München & GeoBio-Center^{LMU}.

I. Biologic Mineralisation: Paleoarchives, natural functional materials and bacterial mineralisation processes. - **E. Griesshaber**, **W. Schmahl**, beide LMU München & GeoBio-Center^{LMU}.

J. Vertebrate diversity and evolution during the Early Mesozoic. - **A. Lopez-Arbarello**, BSPG, **O. Rauhut**, BSPG & LMU München, **R. Butler**, BSPG.

K. Early Palaeozoic Ecosystems. - **O. Lehnert**, Univ. Erlangen.

Im Vorfeld der Tagung werden die Exkursionen A-C durchgeführt:

A) Jura der Frankenalb (Leitung: **W. Werner**, BSPG München),

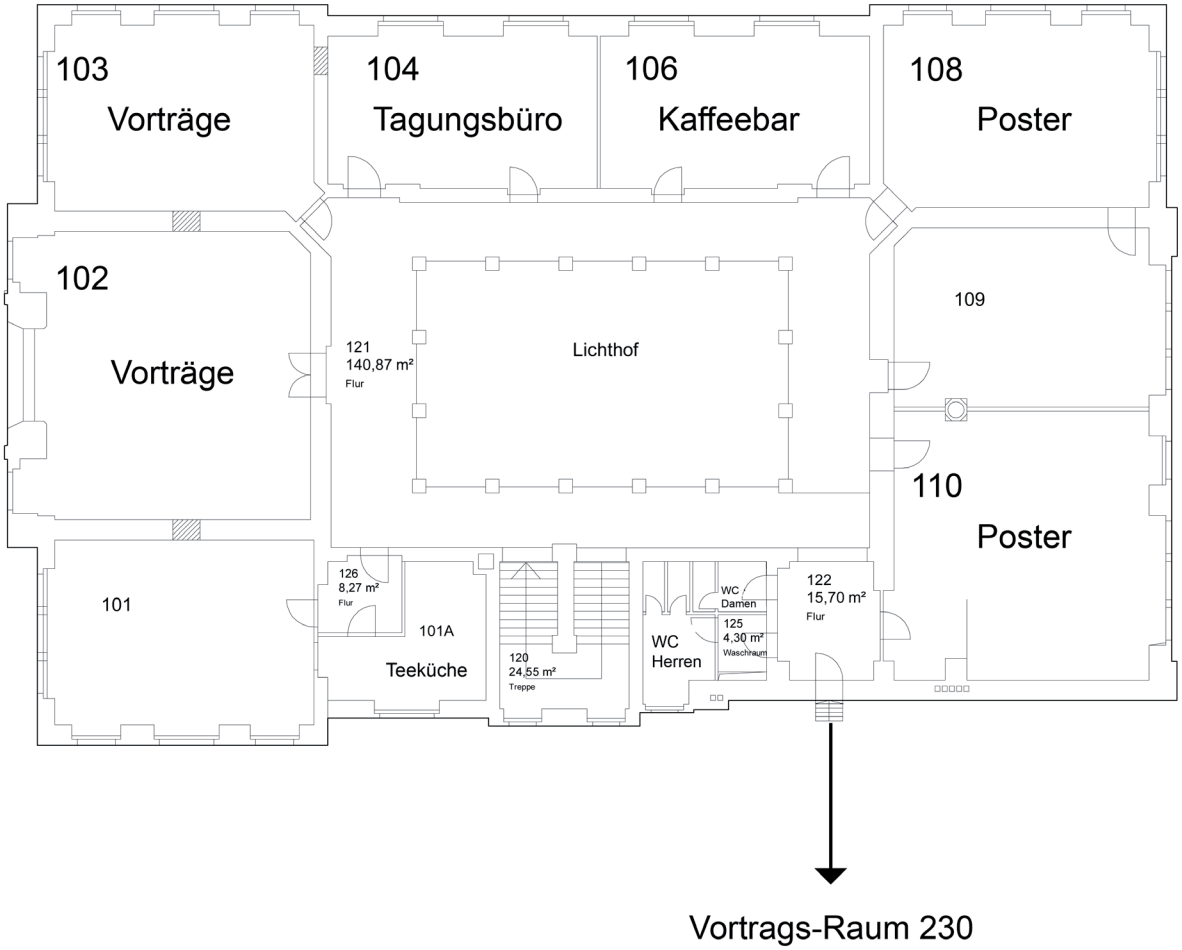
B) Obere Süßwassermolasse (Miozän) im bayerischen Alpenvorland (Leitung: **G. Rößner**, **K. Heissig**, beide BSPG & LMU München),

C) Trias/Jura-Grenze in der Karwendelmulde (GSSP Kuhjoch) (Leitung: **A. von Hillebrandt**, TU Berlin, **K. Kment**, Bad Tölz).

Im Anschluß an die Tagung (11.-15.10.2010) findet der Labor-Kompaktkurs **Methoden der Molekularen Paläobiologie** statt (Leitung: **G. Wörheide**, BSPG & LMU München & GeoBio-Center^{LMU}, **D. Erpenbeck**; LMU München & GeoBio-Center^{LMU}).

Lageplan der Vortragsräume im 1. OG der Richard-Wagner-Str. 10

Raumbelegung 80. Jahrestagung Paläontologische Gesellschaft, 2010



Vortrags-Raum 230

Programm und Zeitplan

Dienstag, 5.10.2010		
8.00 Uhr Exkursionen A, B, C: ab Parkplatz Richard-Wagner-Str. 10 (hinter Museum)		
Tagungsbüro & Registration **16:00 - 20:00, Raum 104**	**Sitzung von Vorstand & Beirat** **14:00 - 18:00, Raum 12**	**Anbringen der Poster** **16:00 - 20:00, Raum 108 & 110**
ab 18:00 Icebreaker-Party, Raum 10		

Mittwoch, 6.10.2010		
8:15 - 8:45 Eröffnung & Begrüßung (in Raum 230)		
8:45 - 9:15 K. Remes (DFG Referent): Tipps und Neuigkeiten aus der DFG (in Raum 230)		
Raum	**230**	**103**
09:15 - 09:55	Symposium H: **R. Asher**: Data Integration and Reconstructing the Mammalian Tree of Life; ***keynote***	Symposium G: **A. Altenbach**: Holistic micropalaeontology; ***keynote***
09:55 - 10:15	**C. Larroux** et al.: What can the sponge genome tell us about the metazoan last common ancestor?	**A. von Hillebrandt**: Wo kommen die planktonischen Foraminiferen her?
10:15 - 10:35	**O. Voigt**, G. Wörheide: When morphology misleads: An example of problems with the taxonomy of extant Calcareous Sponges (Class Calcarea, Phylum Porifera)	**M. Pippèrr**, B. Reichenbacher: Planktonic foraminifera: proxies for palaeo-bathymetry and past sea-surface tempe-ratures? A case history from the early Miocene Upper Marine Molasse Sea
10:35 - 11:00 Kaffeepause / Coffee break (in 106)		
11:00 - 11:20	Symposium H: M. Dohrmann, D. Janussen, A.G. Collins, **G. Wörheide**: Glass, rocks and clocks: prospects and problems of molecular dating in hexactinellid sponges	Symposium D: **N. Dotzler** et al.: Peronosporomycota (Oomycota) in the fossil record
11:20 - 11:40	**D. Erpenbeck** et al.: Progress and work-flow of the Sponge Barcoding Project	**M. Hübers**, H. Kerp: Disperse Kutikulen aus dem Viseum von Glösa bei Chemnitz
11:40 - 12:00	**S. Vargas** et al.: Palaeo-trans-Antarctic connections in 'Polymastia invaginata' (Porifera: Demospongiae)? A case study using ribosomal (28S) DNA markers	**H. Jäger**: Mikrofloren aus dem Obervisé der Nordsee und Sachsens – Hinweise auf paläobotanische Unterschiede zwischen Laurussia und Peri-Gondwana
12:00 - 12:20	**J. Kriwet** et al.: Of genes and fossils: Reconstructing adaptive processes in dog-fish sharks	**R. Kretzschmar**, V. Annacker: Wie gräbt man einen versteinerten Wald aus? Paläobotanik aus Ingenieurssicht
12:20 - 14:00 Mittagspause / Lunch (Mensa-Tickets in 104)		

Raum	**102**	**230**	**103**
14:00 - 14:20	Symposium J: **A. López-Arbarello** et al.: Introduction	Symposium H: **J. Müller** et al.: Genes, development, and fossil morphologies: an example from vertebrates	Symposium D: **R. Rößler** et al.: Die eruptionsnahe Überlieferung eines permischen Ökosystems – Neue Forschungen im Versteinerten Wald von Chemnitz
14:20 - 14:40	**A. López-Arbarello**: The new old era in actinopterygian research	**C. Böhmer** et al.: Correlation between vertebral *Hox* code and vertebral morphology: implications for vertebral evolution in saurodomorph dinosaurs	**W. Konrad**, A. Roth-Nebelsick: A quantitative model linking palaeoenvironment and plant ecophysiology
14:40 - 15:00	**G. Arratia**: Teleostean diversity during the Jurassic and the origin of the crown-group Teleostei	**E. Bärmann**: The benefit of simultaneous analysis of molecular and morphological data – an example from Antilopinae (Bovidae, Cetartiodactyla, Mammalia)	**E. Schrank**, V. Krassilov: Palaeobotanical and palynological studies in the Cretaceous of the Negev Desert, Israel
15:00 - 15:20	**R.R. Schoch**: Patterns of ontogeny and evolution in Mesozoic amphibians	Symposium I: **M.R. Lee**, C. Torney, A.W. Owen: Peering into the crystalline eyes of trilobites; ***keynote***	**C. Coiffard** et al.: Early Cretaceous angiosperms from the palaeoequatorial region and their ecologic adaptations
15:20 - 15:40	**M.E.H. Jones** et al.: The origin and early history of Lepidosauromorpha (Diapsida)		**U. Heimhofer** et al.: Assessing the response of terrestrial palynofloras to the Cenomanian-Turonian Boundary Event
15:40 - 16:00	**S. Renesto**: Diversity, functional morphology and mode of life of the Late Triassic drepanosaur reptiles	**D. Jackson** et al.: An evolutionary fast track to bio-calcification	**R. Butzmann,** T.C. Fischer: Minimal age of *Nymphaea* Subgenus Lotos is Upper Eocene
16:00 - 16:30 Kaffeepause / Coffee break (in 106)			

Mittwoch, 6.10.2010			
Raum	102	230	103
16:30 - 16:50	Symposium J: **P.M. Barrett** et al.: Post-cranial skeletal pneumaticity in Triassic and Early Jurassic non-avian archosaurs and its implications for respiratory evolution	Symposium I: **A. Kappler**: Microbial formation of iron minerals in modern and ancient environments; ***keynote***	Symposium D: **M. Dolezych**: *Metasequoia* – eminent in the Arctic Tertiary of Svalbard and Ellesmere Island, but lacking in the Middle European Tertiary?
16:50 - 17:10	**M.D. Ezcurra**: A review of the macro-evolutionary patterns involved in the early radiation of dinosaurs during the early Mesozoic		**T. Wappler** et al.: Ant-Fungal Parasitism - Ancient Death-Grip Leaf Scars from the Eocene of Central Europe
17:10 - 17:30	X. Xu, J.M. Clark, **C. Sullivan**: Jurassic dinosaurs from Asia: a review of recent discoveries	**M. Hethke** et al.: The role of microbial sealing of laminated sediment in exceptional preservation of Jurassic lake biota from Gansu (China)	**M. Koch** et al.: Pflanzen-Insekten Interaktionen und klimatische Korrelationen im Unter-Oligozän von Mitteleuropa
17:30 - 17:50	**R.J. Butler** et al.: Mesozoic vertebrate diversity, sampling biases, sea level, and insights into the 'common cause' hypothesis	**T. Schulz-Mirbach** et al.: Texture and microstructure of otoliths from cave- and surface-dwelling fish: a high-resolution EBSD study	**Meeting Arbeitskreis für Paläobotanik und Palynologie**
17:50 - 18:10	**T. Martin**, A.O. Averianov: Jurassic mammalian diversity in Central Asia	**D.C. Kalthoff**: Dentine in details: tooth microstructures in extinct ground sloth and glyptodonts (Mammalia, Folivora and Cingulata)	
18:10 - 18:30	**D. Schwarz-Wings**, G. Fritsch: Contents of old Tendaguru bamboo corsets from quarry IG revealed by computed tomography	**U. Balthasar**: Aragonitic brachiopods in a calcite sea	
18:30 - 19:30 Poster session (in 108 & 110)			
20:00 Abendvortrag Prof. Dr. J. Thiede (Geocenter Denmark, Kopenhagen) Altes u. neues Leben in den Polargebieten (in 230)			

Donnerstag, 7.10.2010		
Raum	102	230
09:15 - 09:35		**H. Zankl: Laudatio anlässlich der Goldenen Doktorjubiläen von D. Herm (München) u. A. von Hillebrandt (Berlin)**
09:35 - 09:55	Freie Themen: **P.D. Gingerich**: Fossils and the fractal properties of evolutionary rates: consequences for understanding the evolutionary process	Symposium A: **J. Fischer** et al.: Oxygen isotopes from non-marine shark tooth enameloid – environmental and ecological implications for the Late Palaeozoic of Central Europe
09:55 - 10:15	**H.-P. Schultze**, G. Arratia: Die Plattenkalk-Becken in der südlichen Frankenalb (Bayern, Süd-deutschland) als Ursprungszentren neuer Fischgruppen	**H. Schmied**, Z. Čolić: First evidence of aquatic spiders in the fossil record, identified with new findings of the biomimetic research
10:15 - 10:35	**S. Klug**: Defining stem-lineage neoselachians (Synecho-dontiformes): Implications for the origin and evolution of modern sharks and rays	**C. Böhmer**: Sequentieller Zahnwechsel und Mortalitätsprofil von juvenilen Nashörnern aus dem Miozän
10:35 - 11:00 Kaffeepause / Coffee break (in 106)		
11:00 - 11:20	Freie Themen: **J.A. Lane**: Jaw Morphology in the Lower Cretaceous Hybodont Shark *Tribodus limae*	Symposium A: **M. Buchwitz** et al.: Reconsideration of the chroniosuchian–crocodilian analogy on the basis of new morphological and osteohistological data
11:20 - 11:40	**F.T. Fürsich** et al.: Environmental significance of *Corbulomima* concentrations: The Upper Jurassic Tereñes Formation of Asturias (northern Spain)	**N.S. Heckeberg** et al.: Intraspecific variations in the beak morphology and beak size of the African seed-cracker *Pyrenestes ostrinus*
11:40 - 12:00	**C. Salazar** et al.: Systematic, Biostratigraphy and Paleobiogeography of Ammonoids from the Quiriquina Formation (Maastrichtian), Chile	**P. Grunert** et al.: Well-based stratigraphy and facies analysis of Early Miocene deposits in the North Alpine Foreland Basin (Upper Austria, Salzburg) in the context of global events
12:00 - 12:20	**G. Schweigert** et al.: Die Krebsfauna der oberjurassischen Plattenkalke von Wattendorf (Ober-Kimmeridgium, Nördliche Frankenalb)	**B. Hengst** et al.: The Molluscan-dominated benthic assemblages of the estuarine and shallow marine Upper Burdigalian deposits of the Korneuburg Basin in Lower Austria
12:20 - 12:40	**J.F. Sánchez-Beristain** et al.: Neue Ergebnisse zur Geo- und Biogeochemie ausgewählter Karbonatfazies aus der Cassian Formation	**P. Moisan** et al.: Lycopsids from the Triassic Madygen Lagerstätte (SW Kyrgyzstan, Central Asia)
12:40 - 14:00 Mittagspause / Lunch (Mensa-Tickets in 104)		

Donnerstag, 7.10.2010		
Raum	**102**	**230**
14:00 - 14:20	Freie Themen: **S. Engels**: Functional and morphological changes in the molar morphology of early Hippomorpha	Symposium A: **H. Drapatz**, J. Rust: Die Paläobiologie der Tentakuliten des Hunsrückschiefers
14:20 - 14:40	**J.A. Schultz**, T. Martin: Occlusal surface analysis of dryolestoid molars (Mammalia, Cladotheria)	**A.M. Heyng** et al.: Profilaufnahme der Mörnsheim Formation (Ob. Jura, Tithonian) in Mühlheim (Oberbayern): Stand der Arbeiten
14:40 - 15:00	**U. Anders**: Functional preservation in the mammalian dentition during ontogeny	**M. Voss**: Character evolution, homoplasy and interrelationships of Sirenia
15:00 - 15:20	**F. Spindler**, J. W. Schneider: Probleme und Hypothesen zur Evolution der Sphenacodontia (Synapsida)	**C. Nyhuis**, H.-G. Herbig: Mikrostruktur und Taphonomie der Schalen des pedunkulaten Cirripediers *Lepas anatifera*
15:20 - 15:40		**J. Pardo-Pérez** et al.: Evidence of two new species of *Platypterygius* (Ichthyosauria: Ophthalmo-sauridae) and their palaeobiogeographical significance from the Torres del Paine National Park, Southern Chile
15:40 - 16:00		**F. Gitter** et al.: Faunal similarities between the Frankfurt Formation in the Mainz Basin and surrounding areas
16:00 - 16:30 Kaffeepause / Coffee break (in 106)		
16:30 - 16:50	**Workshop Öffentlichkeitsarbeit** **Leitung: Dr. A. Hesse**	Symposium A: **A.H. Schwermann**, T. Martin: Teilskelett eines *Geotrypus* (Mammalia, Talpidae) aus dem Oberoligozän von Enspel
16:50 - 17:10		**M. Altner**, G. Grupe: Untersuchung von Hartteilen einer frühneuzeitlichen Skelettserie aus Dohna (Sachsen)
17:10 - 17:30		**J.F. Sánchez-Beristain**: Palökologische Analyse ausgewählter Schwamm-Mikroinkrustierer-Gemeinschaften aus den Cipit-Kalken der Cassian Formation (Unterkarn, Obertrias) anhand statistischer Methoden
17:30 - 17:50		**C. Joachim** et al.: Biological response to short-termed ocean acidification events in the past: biodiversity and evolution patterns of marine primary producers (calcareous nannofossils) during the PETM (Demerara Rise)
17:50 - 18:30 Poster session (in 108 & 110)		
Ab 18:30 Mitgliederversammlung (in 230)		

Freitag 8.10.2010			
Raum	**102**	**230**	**103**
08:30 - 09:10	Symposium K: **T. Servais** et al.: Cambrian Explosion and Ordovician Biodiversification or Cambrian Biodiversification and Ordovician Explosion? ***keynote***	Symposium B: **M. Kowalewski**: Macroevolution and macroecology of mollusc-dominated benthic associations; ***keynote***	Symposium F: **I. Casanovas-Vilar** et al.: Long-term biogeographic and diversity patterns in the Miocene Iberian mammal record; ***keynote***
09:10 - 09:30	**O. Lehnert** et al.: Is the Ordovician explosion in the diversity of life related to climate cooling and glacial intervals?	**M.R.W. Amler**: High diversity in a minor molluscan class - Rostroconchia and their occurrence in the Palaeozoic record	**J.P. Gailer**, T.M. Kaiser: Quantifying chewing efficiency of ruminant dental patterns – an approach using three-dimensional metrology systems
09:30 - 09:50	**E. Nardin** et al.: Environmental context of the Ordovician biodiversification	**A. Kaim**, A. Nützel: Gastropod recovery after Permian-Triassic mass extinction	**R. Schellhorn**: Cannon bones – and what they can tell
09:50 - 10:10	**O. Elicki** et al.: Cambrian trace fossils from the north-eastern Africa – Middle East segment of Perigondwana	**M. Hautmann**: The Triassic radiation of bivalves	**U. Göhlich** et al.: Completing a 100 years lasting puzzle of the fossil lemur skull of *Hadropithecus* (Archaeolemuridae)
10:10 - 10:30	**O. Lehnert** et al.: Yellowstone-like microbial environments in Tremadocian hydrothermal vent systems at the northern Gondwana margin (Prague Basin, Czech Republic)	**A. Nützel**: Early gastropod dominance in Late Paleozoic/Early Mesozoic communities	**J. Hír**: A short sketch on the studies of middle Miocene fossil rodent faunas in the Pannonian Basin
10:30 - 11:00 Kaffeepause / Coffee break (in 106)			

Freitag 8.10.2010			
	HS 102	**HS 230**	**HS 103**
11:00 - 11:20	Symposium K: **B. Schoenemann** et al.: The Sophisticated Strategy of a Tiny Eye	Symposium B: **H. Löser**: Diversity changes in Nerineid gastropods	Symposium F: **W. von Koenigswald**: Hypsodonte Säugetierzähne klassifiziert als heterochrone Bildungen
11:20 - 11:40	**R. Lerosey-Aubril**, T. Hegna: Inferring internal anatomy from the trilobite exoskeleton: the relationship between frontal auxiliary impressions and the digestive system	**S. Schneider** et al.: Fossil and extant Unionidae of Southeast Asia – Species concepts and radiation patterns	**J.J. Brinkkötter**, T. Martin: Die Großberg-Bank – eine neue Fundstelle für terrestrische Mammalia im Mainzer Becken am Übergang von MN1 zu MN2 (frühestes Miozän)
11:40 - 12:00	**A. Bergmann** et al.: A re-examination of *Nahecaris balssi* and *Palaeoscorpius devonicus* from the Lower Devonian Hunsrück Slate (Germany).	**S.N. Nielsen**: New Pliocene mollusc faunas from Chile: filling some gaps in age, diversity and biogeography	**U. Richter** et al.: Ein neues Taxon didactyler Theropoden-Fährten aus dem Mitteljura der Rep. Niger, Afrika
12:00 - 12:20	**F. Witzmann**: Morphological and histological changes of dermal scales during the fish-to-tetrapod transition	**S. Urdy** et al.: How do recurrent patterns of covariation in molluscan shells connect to growth dynamics?	
12:20 - 14:00 Mittagspause / Lunch (Mensa-Tickets in 104)			
14:00 - 14:40	Symposium C: **E. Gischler**: Quaternary coral reefs as archives of environmental and climate change; ***keynote***	Symposium B: **G. Haszprunar**, B. Ruthensteiner: News and thoughts on Monoplacophora: Their role in molluscan phylogeny; ***keynote***	Symposium E: **B.J. Axsmith**: Triassic gymnosperms, evo-devo, and the origin of angiosperms? ***keynote***
14:40 - 15:00	**S. Götz**: Growth and carbonate production inside Cretaceous rudist reefs	**D. Fuchs** et al.: Multiple reasons why the cephalopod taxon „Neocoleoidea“ is not monophyletic	**E. Kustatscher**, J. van Konijnenburg-van Cittert: How did the Cycads evolve in Central Europe during the Triassic?
15:00 - 15:20	**E. Pascual**, S. Götz: Calcite/Aragonite ratio fluctuations in rudist bivalves. Quantitative data based on serial grinding tomography	**R.T. Becker**, S. Hartenfels: Der Faunenwechsel bei Ammonoideen des mittleren Famenniums (Oberdevon III/IV) – Folge einer globalen trophischen Krise in Außenschelfen?	**C. Pott** et al.: 'Arms race' in the Mesozoic: bennettitalean response to insect feeding
15:20 - 15:40	**D. Hennhöfer**, S. Götz: Quantitative paleobiology of a Biradiolites mooretownensis – bouquet (Maastrichtian, Guinea Corn Formation, Central Jamaica)	**B. Seuß** et al.: Cameral deposits in a sublethally damaged Carboniferous orthoconic nautiloid from the Buckhorn Asphalt Lagerstätte in Oklahoma, USA	**B. Bomfleur** et al.: Gymnosperm diversity in the Triassic of Antarctica: the enigmatic seed fern *Dejerseya*
15:40 - 16:00	**C. Vogler** et al.: Past current affairs: phylogeography of the crown-of-thorns starfish in the Indian Ocean	**E. Nagm**, M. Wilmsen: Ammonite biostratigraphy of the lower Upper Cretaceous (Cenomanian – Turonian) of the north Eastern Desert (Wadi Araba area, Egypt)	**C.T. Gee**: Neue Funde von fossilen Araukarien aus Utah und ihre Bedeutung für die Koniferen-Diversität in der oberjurassischen Morrison Formation
16:00 - 16:30 Kaffeepause / Coffee break (in 106)			
16:30 - 16:50	Symposium C: **R. Aryasari** et al.: Population structure of selected sponge species (Porifera: Demospongiae) from the Indonesian Archipelago	Symposium B: **M. Wilmsen**, E. Nagm: Tempo of evolutionary change in the Early Turonian (Cretaceous) ammonite genus *Choffaticeras* Hyatt, 1903	Symposium E: **B. Mohr** et al.: The gymnosperm component of early Cretaceous palaeoequatorial environments, as seen in the Crato flora of northeastern Brazil
16:50 - 17:10	**K. Karlinska**, G. Wörheide: Phylogenetic diversity of microbial symbionts in the coralline sponge *Astrosclera willeyana* from distant geographical regions (Red Sea-Egypt versus Great Barrier Reef-Australia)	**J.W. Huntley**, D. Scarponi: Evolutionary and ecological implications of trematode parasitism of modern and fossil northern Adriatic bivalves	**L. Kunzmann**, D.H. Mai: Late Cretaceous conifer diversity: new data from the Maastrichtian flora of Walbeck (Germany)
17:10 - 18:30 Poster session (in 108 & 110)			
Ab 19:30 Gemeinsames Abendessen & geselliges Beisammensein im Löwenbräukeller (Nymphenburger Str. 2) mit Bekanntgabe der Gewinner/innen: Zukunftspreis, 1.-3. Posterpreis, "Fossil des Jahres"			

Kurzfassung des Öffentlichen Abendvortrags

Mittwoch, 6.10.2010 20.00 Uhr

Altes und neues Leben in den Polargebieten

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Die natürlichen Eigenschaften der Polargebiete haben sich in der Erdneuzeit dramatisch verändert und sind heute Gegenstände intensivster Forschung, weil man hier Auswirkungen globaler Umweltveränderungen am schnellsten und deutlichsten sehen kann. Diese Veränderungen betreffen zunächst vor allem die Physiographie der polaren Meeres- und Landgebiete, nachdem plattentektonische Bewegungen zur Positionierung eines Kontinentes über dem Südpol und eines relativ kleinen Ozeanbeckens über dem Nordpol führten. Dadurch wurden sie klimatisch isoliert, kühlten in mehreren Schritten soweit ab, dass sich in hohen nördlichen und südlichen Breiten einigermaßen gleichzeitig Eisbedeckungen entwickeln konnten, sowohl an Land wie auch auf dem Meer. Trotz wiederholter „Eiszeiten" während der Milliarden Jahre langen Erdgeschichte, die aber aufgrund der damaligen Paläogeographie meist unipolar waren, erleben wir heute eine bipolare Vereisung, die noch anhält und die sich schnell verändern kann, wie die jüngste geologische Geschichte gezeigt hat. Die ersten Spuren einer känozoischen Eisbedeckung in der Antarktis sind etwa 40-45 Mio. Jahre alt, in der Arktis sogar 45-48 Mio. Jahre, obwohl beide Polargebiete noch wenige Millionen Jahre vorher unter dem Einfluss gemäßigter, sogar subtropischer Klimate lagen. Der Arktische Ozean, die kontinentale Kruste unter den Eisschilden der Antarktis sowie Grönlands sind die größten, noch fast völlig unbekannten geologischen Provinzen unserer Erde.

Die modernen marinen und Faunen und Floren in den Ozeanbecken hoher nördlicher und südlicher Breiten werden erst heute erfasst, weil uns mit der POLARSTERN ein moderner Forschungseisbrecher für die Arbeiten in den eisbedeckten Meeresgebieten zur Verfügung steht. Ihre Sammlungen haben die Existenz von Tiefseefaunen großer Vielfalt ergeben, mit uralten, lebenden Schwämmen im Südozean und riesigen Kaltwasserkorallenriffen im Nordmeer. In ihrer Entwicklungsgeschichte mussten die marinen Faunen und Floren sich auf die Veränderungen von Geographie und Umweltbedingungen einstellen, entweder durch Anpassung oder Entwicklung; und ganz neue Ökosysteme konnten oft unbesetzte Lebensräume erobern. Das geschieht auch heute noch, nachdem die großen Eisschelfe abbröckeln und damit bisher nicht besiedelte Lebensräume freigeben. Wie lange die Eisschilde der Arktis und Antarktis bestehen und welche Tiere und Pflanzen dort vor ihrer Entstehung lebten, ist nur wenig bekannt. Die neuesten und aufregendsten Entdeckungen betreffen die hydraulischen Systeme an der Grenzfläche zwischen der Kruste und den darüber liegenden, mehrere Tausend Meter mächtigen Eisschilden. Dort gibt es subglaziale, bis mehrere hundert Meter tiefe Seen und Flusssysteme, über die sie kommunizieren können. In ihren Wassermassen, die für Millionen von Jahren vom Kontakt mit der Atmosphäre abgeschnitten waren, vermutet man geheimnisvolle Mikrobenfloren unbekannter Zusammensetzung, vielleicht ähnlich wie auf eisbedeckten, extra-terrestrischen Himmelskörpern. Es gibt also großen Forschungsbedarf über Eigenschaften und Entwicklungsgeschichte der polaren Floren und Faunen in den letzten 50 Millionen Jahren.

Lichthof Paläontologisches Museum München
im Vordergrund Urelefant *Gomphotherium* aff. *steinheimense* (KLÄHN)

Symposium G – Poster

Der Einfluß der globalen Frasnes-Events (basales Oberdevon) auf Conodonten-Abfolgen im östlichen Rheinischen Schiefergebirge

Z. Sarah Aboussalam, R. Thomas Becker
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Der Grenzbereich Mittel-/Oberdevon ist global durch eine mehrphasige Folge eustatischer Re-/Transgressionspulse und durch regional unterschiedliche Episoden von Schwarzschiefern oder dunklen, C_{org}-reichen Stylioliniten gekennzeichnet. Dieses als Frasnes-Events bezeichnete Krisen-Intervall führte zu massivem Aussterben, vor allem bei Ammonoideen (Pharciceratacea), zu drastischen Änderungen in Riff-Habitaten, ist aber bei anderen Fossilgruppen bisher kaum untersucht worden. Analysen der Conodonten-Faunen des jüngsten Givetiums und basalen Frasnium von S-Marokko (Aboussalam & Becker 2007) und S-Frankreich (Aboussalam & Becker 2009) bestätigten ein signifikantes Aussterben, vor allem direkt an der Seriengrenze. Zahlreiche Conodonten-Daten für den Grenzbereich Mittel-/Oberdevon liegen im Rheinischen Schiefergebirge in der Literatur verstreut vor, jedoch ohne spezifischen Bezug auf die Frasnes-Events.

Neue Untersuchungen konzentrierten sich auf eine Bank-für-Bank-Aufnahme des klassischen Profils am Burghagen N von Giebringhausen im Ost-Sauerland, welches bei der Etablierung der Standard-Zonierung des Givetiums eine große Rolle spielte (z.B. Ziegler et al. 1976, Ziegler & Klapper 1982). Eine detaillierte Darstellung der Conodonten-Abfolge wurde bislang nie publiziert, obwohl z.T. diverse Faunen sehr seltene und unbenannte Taxa enthalten. Es handelt sich insgesamt um eine Makrofossil-arme Wechsellagerung distaler, riffdetritischer bzw. turbiditischer, dünn- oder dickbankiger Flinzkalke mit hellen – schwarzen Tonschiefern. Die heute noch anstehende Folge beginnt im Niveau des oberen Taghanic-Events (*semialternans*-Zone, höchstes Mittel-Givetium) und reicht bis in die *Ancyrodella rotundiloba soluta*-Zone (MN 2-Zone) des tiefen Frasniums. Alle Conodonten-(Sub-)Zonen des Ober-Givetiums können nachgewiesen werden.

Die *hermanni*-Zone und *dengleri dengleri*-Subzone sind besonders geringmächtig, als Anzeichen episodisch geringer Erosion des Briloner Riffes. Die Dominanz ramiformer gegenüber Plattform-Elementen in spezifischen Bänken belegt eine starke hydraulische Sortierung in den Suspensionsströmen und erschwert teilweise die Zonen-Grenzziehung. Die *norrisi*-Zone des höchsten Givetiums ist besonders mächtig und im unteren Teil sehr artenreich. In diesem Niveau setzen viele Taxa neu ein (z.B. *Mesotaxis guanwushanensis*), darunter Neunachweise für Mittel-Europa (z.B. *Polygnathus aequidivisus*, *Po. pseudoxylus, Tortodus schultzei, T. subsymmetricus, Ctenopolygnathus lanei*), seltene neue Arten von *Polygnathus* und *Schmidtognathus*, sowie seltsame, wahrscheinlich pathologische Formen. Neue *Tortodus*-Arten mit glatter Plattform leiten zu ältesten *Ancyrognathus* des Frasniums über.

Zwei Intervalle sehr dunkler Kalke und Schwarzschiefer repräsentieren getrennte Phasen der Frasnes-Krise. Die erste C_{org}-reichere Schichtfolge, markiert durch einen starken Rückgang der Conodonten-Führung, beginnt im höheren Teil der *norrisi*-Zone und reicht ca. bis zur Givetium-/Frasnium-Grenze. Eine markanter entwickelte und mächtigere schwarze Folge mit Conodonten-Armut beginnt innerhalb der *rotundiloba pristina*-Zone und reicht bis in die höhere *rotundiloba soluta*-Zone. Sie erlaubt eine klare Korrelation mit der hypoxischen Hauptphase des Tafilalt und der Montagne Noire. Wie in diesen Regionen, erreichen auch im Ostsauerland wichtige Givetium-Leitformen (z.B. *Klapperina, Schmidtognathus*) nicht das tiefe Frasnium.

Symposium F – Poster

Gratkorn [A] – A unique terrestrial Sarmatian (~12 Ma) locality: Larger herbivores in outstanding high quality and rich quantity for their time

Manuela Aiglstorfer[1,2], Hérve Bocherens[1], Madelaine Böhme[1,2], Martin Gross[3], Jerome Prieto[1,2,4]
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The small town Gratkorn is located at the northeastern realm of the Styrian Basin (Austria), near the Alpine escarpment, 10 km north of Graz. With so far 62 recorded taxa, it hosts one of the richest and most complete terrestrial vertebrate faunas of the late Middle Miocene (~ 12 Ma; Gross et al. subm.). Important to note, it is one of the very few localities from the Sarmatian *sensu stricto* in the Paratethys realm with a vertebrate fauna in high quality and rich quantity. Interestingly even subarticulated skeletons were excavated (Gross et al. subm.). Furthermore the Gratkorn locality shows, as an ecotone between the Alpine Orogen and the wide Styrian Basin, a faunal assemblage with elements of both ecosystems. The vertebrate bearing horizon of Gratkorn is located at the base of the clay pit St. Stefan and comprises a soil formation on top of a braided river sequence. Besides many smaller mammals, reptiles, amphibians, fishes and some remains of birds, a wide range of larger mammals was excavated so far. Apart from the proboscidean *Deinotherium giganteum* the larger herbivorous vertebrates of the Gratkorn fauna are represented by the odd-toed ungulate *Chalicotherium goldfussi*, the three-toed horse *Anchitherium*, the giraffoid deer *Palaeomeryx*, two to three rhinoceroses (*Brachypotherium*, *Lartetotherium*, *Dicerorhinus*; pers. com. K. Heißig), two different genera of pigs, *Parachleuastochoerus* and *Listriodon,* a chevrotain (*Dorcatherium naui*), the musk deer *Micromeryx flourensianus* and the deer *Euprox furcatus*. The animals lived in a diversified landscape with fluvial channels, temporarily moist floodplains, short-lived ponds, savannah-like open areas and screes (Gross et al. subm.). A mean annual temperature of about 15°C and a mean annual precipitation of about 486 +/- 252 mm is reconstructed for the semiarid, subtropical climate by sedimentological considerations as well as from biota (Gross et al. subm.). First data

for carbon and oxygen isotopic values in the dental enamel of larger herbivores from Gratkorn already give some indications of ecology. Carbon isotope values of teeth can be used to differ between C3 (e.g. trees, shrubs, forbs, cool-season grasses) and C4 (mainly tropical, warm-season sedges and grasses) plant feeders. C3 and C4 plants have different photosynthetic pathways and therefore a different isotopic composition. Typical C3 plant feeders show values between -16 to -9 ‰ VPDB for $\delta^{13}C_{CO3}$, in contrast to C4 plant feeders, which have higher values with -1 to +3 ‰ VPDB. Although all larger herbivores from Gratkorn show typical values for C3 plant feeders, interspecific and intraspecific differences were observed: Great differences in $\delta^{13}C$ and $\delta^{18}O$ values for two measured individuals of the same deer species (*Euprox furcatus*) may be due to different food sources. Some herds fed on plants in the open landscape of the Styrian Basin (higher evaporation), and therefore show higher values for $\delta^{13}C$ and $\delta^{18}O$, whereas others, who fed on plants in the more closed nearby environments, show lower values for $\delta^{13}C$ and $\delta^{18}O$. Additional depletion in $\delta^{18}O$ values for the closed nearby environments were possibly created by cold mountain creeks. Pigs often show low values in $\delta^{18}O$ due to feeding on underground rhizomes. The differences for $\delta^{18}O$ values in the two pigs, might be explained with *Parachleuastochoerus* feeding more on roots than *Listriodon*. Additionally a different degree in omnivory might be a factor influencing the values. The role of the tragulid *Dorcatherium* is not clear yet, but as it is assumed to be at least partly aquatic, further investigations will most probably lead to interesting results. Of course only first assumptions for the interpretation of the stable isotopic composition can be ventured here. In the future these data will lead to an improved interpretation of the ecology of the Sarmatian Gratkorn community.

Gross, M., Böhme, M. & Prieto, J. (subm.): Gratkorn – A benchmark locality for the continental Sarmatian s. str. of the Central Paratethys. – International Journal of Earth Sciences.

Symposium B – Poster

Ammonitenstratigraphie des Oberjura von Kachchh, W-Indien: Rahmen für die Rekonstruktion von Klima- und Ablagerungsbedingungen

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Das Kachchh-Becken im westlichen Indien bildete sich in Folge des Riftings zwischen Afrika und Indien während der späten Trias. Sedimente des Bajoc bis Tithon sind in einer Kette von Aufwölbungen auf dem sogenannten Kachchh Mainland aufgeschlossen. Das Top der Chari Formation (Callov-Oxford) wird von dem Dhosa Oolite member gebildet. Diese Einheit wird zum Hangenden von einer sehr komplexen, kondensierten Lage abgeschlossen, dem Dhosa Conglomerate Bed. Trotz dessen großer Bedeutung als Leithorizont, der über mehr als 100 km verfolgbar ist, gibt es bisher kein Modell, welches die Entstehung dieser Gesteinsschicht umfassend erklärt.

Detaillierte Geländeaufnahmen lassen auf mindestens zwei Auftauchphasen schließen, die ihre Spur in Form von Lösungshohlräumen sowohl auf Sedimentoberflächen als auch im Gestein hinterließen. Getrennt sind diese Phasen durch eine Transgression, während der das Meer das Becken erneut flutete. In diesem Intervall haben hochenergetische Prozesse den Meeresboden beeinflusst, was z.B. durch bewegte, metergroße Konkretionen belegt ist. Erdbeben oder dadurch ausgelöste Tsunamis im von Störungen begrenzten Becken sind hierfür eine mögliche Erklärung.

Relative Meeresspiegelschwankungen können entweder durch klimatische (globale) oder tektonische (regionale) Faktoren ausgelöst werden. Stabile Isotopen von mehr als 100 Belemniten wurden gemessen, um die Temperaturentwicklung im Oberjura von Kachchh zu rekonstruieren. Vorläufige Ergebnisse deuten auf ein Temperaturminimum während der Ablagerung des Dhosa Conglomerate Bed hin (globale Abkühlung mit damit zusammenhängenden Meeresspiegelabfall). Auch wenn es die stratigraphische Auflösung nicht zulässt, beide Auftauchphasen durch stabile Isotopen nachzuweisen, so untermauern die Ergebnisse dennoch die auf dem sedimentologischen Befund basierenden Interpretationen. Weitere Messungen stabiler Isotopen benthischer Organismen (Brachiopoden oder Austern) sowie Tonmineralanalysen sollen diese Befunde stützen.

Ammoniten sind im Oberjura des Kachchh-Beckens häufig, jedoch oft auf einzelne Schichten beschränkt. Die über 300 Ammoniten aus dem untersuchten Profilabschnitt von Kachchh Mainland können verschiedenen Ammonitenzonen vom oberen Callov (athleta Zone) bis zum oberen Kimmeridge (katrolensis Zone) zugeordnet werden. Auffallend ist das Fehlen von Ammoniten aus Teilen des oberen Oxford sowie des unteren Kimmeridge, was auf eine prominente Schichtlücke oberhalb des Dhosa Conglomerate Beds hindeutet. Die gesammelten Ammoniten des geringmächtigen Leithorizontes stammen aus dem unteren und mittleren Oxford. Häufige Aufarbeitungsphasen während eines Intervalls verminderter Sedimentation führten zu zeitlicher Mittelung in dieser Schicht. Die zeitliche Einordnung der beschriebenen Beckenentwicklung erfolgte daher indirekt.

Die Entwicklung des Klimas während des späten Jura ist immer noch stark umstritten; so wurden in jüngster Zeit völlig widersprüchliche Ansichten publiziert. Die Rekonstruktion der Klimaverhältnisse in Kachchh in Verbindung mit präziser Ammonitenstratigraphie kann deshalb helfen Licht in diesen Aspekt der Erdgeschichte zu bringen.

Symposium G – Keynote

Holistic micropalaeontology

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James Hutton stated in 1788 that we can't understand system earth without regard to its biota, and vice versa. Nothing happened for long. However, confluent to the dawn of fossil energy sources and according social adjustments, palaeontological research and teaching found extra time to spread from common palaeoecology and palaeoclimatology towards global change. Neontological investigations transformed from reconstructing the primeval towards understanding dynamics. Most promising for micropalaeontologists, no other discipline should carrie more efficiently all benefits recommended in biostratigraphy and palaeoecology into modern geobiology, because the heart of interactions between bio- and geosphere is virtually a microbial domain. Indeed, recent outcomes from micropalaeontologial research decoded substantial contradictions in biological and palaeontological approvals. Surprisingly, some erratic assumptions are derived from the rejection of results from other sub-disciplines, just in order to retain own axioms. Counter examples from trophic and biogeochemical research can highlight that geobiology offers pathways for environmental studies much superior to investigations restricted to limited sub-disciplines. Holistic life sciences offer substantial, if not even mandatory, opportunities for the future, rather than a fashionable trend. Micropaleontology has the potential to evolve to a key player in the fusion of disciplines, hopefully. Worth to note, and proven by examples presented, good old taxonomy will be indispensable for that.

Symposium A – Vortrag/oral presentation

Untersuchung von Hartteilen einer frühneuzeitlichen Skelettserie aus Dohna (Sachsen)

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Im Zuge des Baus einer Rollstuhlrampe auf dem Friedhofsareal rund um die Marien-Kirche in Dohna im Landkreis Sächsische Schweiz-Osterzgebirge kamen 116 Bestattungen zu Tage, von denen 97 aus der Zeit zwischen 1500 und 1868 datieren. Der Großteil der Gräber wies Rückstände von Särgen in Form von Holzresten oder Sarggriffen auf. Lediglich in vier Gräbern befanden sich Beigaben. Zunächst wurden eine morphologische Geschlechts- und Altersbestimmung sowie osteometrische Analysen durchgeführt. In der Population spiegelt sich ein nahezu ausgeglichenes Geschlechterverhältnis mit leichtem Männerüberschuss wider. Die Sterbealtersverteilung weicht stark von der erwarteten ab: Den größten Anteil bilden die frühadulten Individuen und nicht die spätadulten. Darunter befanden sich zwei weibliche Individuen, die mit großer Wahrscheinlichkeit mit ihren Säuglingen bzw. ungeborenen Föten bestattet wurden. Der archäologischen Datierung nach fallen die Skelette in mehrere Kriegszeiten, doch konnten keine eindeutigen Kriegsverletzungen nachgewiesen werden. Auffallend oft traten Schädeltraumata auf, die jedoch nicht tödlich waren. Da das biologische Alter oft in Folge von äußeren Einflüssen von dem chronologischen Alter abweicht, sollten beide Alter mit Hilfe histologischer Methoden verglichen werden und gleichzeitig die Genauigkeit der Methoden überprüft werden. Mit der TCA-(Tooth-Cementum-Annulation) Methode wurde an 36 Zähnen (33 Prämolaren und drei Molaren) das chronologischen Alter bestimmt. Hierbei werden die jährlich um die Wurzel angelegten Zahnzementringe ausgezählt und zu dem Durchbruchsalter hinzu addiert. Zum größten Teil stimmt das morphologisch bestimmte Alter mit dem chronologischen Alter überein, jedoch traten Probleme wie der schlechter Erhaltungsgrad, Doubling (eine Verdoppelung der Zementringe) und die oft diskutierte Altersunterschätzung der über 40-Jährigen auf. Zusätzlich sollte an allen vorhandenen Femora das histologische Alter nach Maat (2006) bestimmt werden. Erneut wurde dies durch den schlechten Erhaltungsgrad erschwert. Im Laufe des Lebens werden die primären Osteone durch sekundäre Osteone ersetzt. Da die Umbaurate bekannt ist, lässt sich das Alter durch Auszählen der Kästchen eines vorgegebenen Gitters, die nicht- umgebauten Knochen enthalten und Einfügen dieser Zahl in eine Regressionsgleichung bestimmen. Wiederum stimmt der Großteil mit dem morphologisch bestimmten Alter überein. Weiterhin wurden diverse Skelettelemente röntgenologisch auf Pathologien hin untersucht. Eine wichtige Rolle bei der paläodemographischen Untersuchung einer Population spielen sogenannte Stressmarker, die als Haltelinien im mikroskopischen Knochenschnitt, bzw. Krisenringe im Zahnschnitt sowie in Form von Harris-Lines im Röntgenbild zu sehen sind. Im Gegensatz zu den minder- mineralisierten Haltelinien und Krisenringen sind die sogenannten Harris-Lines hypermineralisierte Linien, die durch einen Wachstumsstopp und einer nachfolgenden Erholungsphase entstehen. Sie treten in Folge von Schwangerschaften, Nierenerkrankungen und anderen „Krisen" auf. Es konnten bei ca. 20 Prozent der untersuchten Tibien Harris-Lines nachgewiesen werden. Es scheint, als hätte in der Population ein saisonales Geschehen stattgefunden, welches sich in Form kurz aufeinander folgender Harris-Lines niederschlägt. Allerdings traten Begleiterscheinungen von „Krisen" wie Zähne mit Schmelzhypoplasien, Cribra Orbitalia und Rachitis auffallend selten auf . Nach Auswertung der morphologischen, histologischen und röntgenologischen Daten stellt sich die Population insgesamt als relativ gesund dar.

Symposium B – Vortrag/oral presentation

High diversity in a minor molluscan class – Rostroconchia and their occurrence in the Palaeozoic record

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Compared with cephalopods, gastropods and bivalves, rostroconchs – although generally present but rarely specifically determined – were less diversified and less abundant molluscs in Palaeozoic shelf environments. The class Rostroconchia was introduced for a group of pseudobivalved fossils which had previously been treated as crustaceans or aberrant bivalves. One of the group's most distinctive autapomorphic characters, apart from connecting shell layers between left and right valves, is the univalved cap-shaped larval shell of these taxa. It is always divided into a teardrop-shaped protoconch I and a posteriorly bilobed but still univalved protoconch II. Both larval stages are separated from each other or from the following juvenile dissoconch by a more or less distinct suture. Compared with the shape of the adult shell, the larval shells cover the soft parts only dorsally and do not envelope the mollusc completely.

The early rostroconchs are thought to be direct descendents from mid-Cambrian monoplacophoran-like univalves by a group of more plesiomorphic characters, diversified into the Ischyrinioida, Ribeirioida and Technophorioida in the Early Ordovician and became extinct near the end of the Ordovician. The most advanced group of rostroconchs, the order Conocardioida, can be traced back into the Early Ordovician. This taxon is split up into three superfamilies and became extinct by mid-Permian time. The presumed stem-group and link to the ribeirioids is represented by the superfamily Eopterioidea, ranging from Early to Middle Ordovician. The superfamily Hippocardioidea is known best and divided into two families, whereas the superfamily Conocardioidea in a restricted sense is still under study. The early diversification of these three taxa started with the Early Ordovician radiation, followed by a second diversification acme in the mid-Silurian. The most important diversification acmes, however, linked with size increase, occurred during the Early Devonian and the Early Carboniferous.

The lateral distribution of conocardiid rostroconchs was controlled by various factors, e.g., nutrient supply, facies stability, salinity, habitat grain size, oxygen content, water temperature, etc., but only few of them well understood. Based on morphological variation in anatomical characters and palaeobiological constraints, several life styles were realized for occupation of different niches. Consequently, some taxa occurred widespread in unstable and variable facies realms, whereas others were restricted to specific habitats without distinct indication. In addition, some taxa were observed to show ecophenotypes with morphological variation under different facies conditions often difficult to observe due to imperfect preservation. Indiscernible biological factors also seem to play an important role for the geographical distribution, e.g., the duration of the planktonic larval stage. Therefore, distribution patterns are presently based solely on the discovered known occurrence of adult stages.

Contrasting with previous views, the hood (German „Schleppe", French „éventail"), the diagnostic feature of the Hippocardioidea, is part of the basic conocardiid bauplan since the mid-Ordovician and not an apomorphic specialization within later stages of the conocardiid phylogeny. The Conocardioidea, originally thought to be the stem-group of the Conocardiida, was the more advanced morphotype that was able to burrow and lived analogous with scaphopods.

Evolution and diversification of the Hippocardioidea and Conocardioidea are linked with their life habits, often reflected by morphological features. The basic morphotype infers immobile mud- and sand-sticking in almost vertical orientation. Enlarged anterior gaping and reduction of the hood points towards epifaunal crawling, and the loss of the hood in the Conocardioidea indicates a mobile, nearly endobenthic life position as in scaphopods.

Hitherto, hippocardioid rostroconchs have been interpreted as suspension feeders or detritus feeders without considering morphological constraints. Suspension feeding or detritus feeding, respectively, as the sole feeding type can be excluded due to the unsuitable cross-section of the rostrum and the immobility of the animal caused by the hood. Instead, morphological characters provide conclusive evidence that palaeophotosymbiosis was realized in hippocardioid rostroconchs. Symbiosis with photoautotrophic zooxanthellae provided photosynthetical products that were necessary to satisfy basic nutritional demands of the animals. Hippocardioids also may have collected organic detritus with the help of mantle extensions or captaculae. Although originally restricted to particular environments this dual-track ability of nutrition enabled the group to occupy different niches and, thus, enhenced diversification of the group. Zooxanthellae are unlikely to be preserved in the fossil record – a palaeophotosymbiosis can be traced by circumstantial evidence and palaeobiological constraints only. These include, a.o., (1) light exposure: apart from the hood as additional carpeting surface for the mantle tissue, simple prismatic spots are developed in the shell microstructure which allow transmission of light into the interior of the shell; (2) increased rate of calcification: some Carboniferous taxa are prone to gigantism and generally the conchs are particularly thick-shelled.

Freie Themen – Vortrag/oral presentation

Functional preservation in the mammalian dentition during ontogeny

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For energy requirement it is essential to provide a full functional dentition. Shearing edges, cusps and basins on the occlusal surface allow an optimal reduction of different kinds of food. During ontogeny, wear causes the loss of shearing and crushing elements. To avoid the reduction of functional efficiency in late age stages, different strategies have evolved

in various mammalian tooth types.

In the selenodont dentition of many artiodactyls shearing edges are exposed shortly after the eruption of teeth. In juvenile stages the molarised deciduous premolars with an increased number of shearing edges resume the function of the later erupting permanent teeth. In contrast these edges first merge together and finally disappear in old aged individuals. The reduced number of shearing elements caused by wear may imply a limiting factor for the individual life span. On the other hand, bovids have evolved hypsodont teeth. With more tooth material to wear down and a longer period of tooth eruption the full functionality on the occlusal surface can be preserved for a longer time.

Shearing edges are also important in the carnassials in the secodont dentition of carnivores. But due to the orthal chewing direction only moderate wear can be observed in hypercarnivorous animals, e.g. *Crocuta spelaea*. The length and angle of shearing edges remains almost constant during life which preserves the functionality for a long time. However, some species with a more general dentition, e.g. *Canis lupus*, loose their shearing edges in late age stages. Therefore, in some carnivorous species, e.g. the creodont *Hyaenodon*, a rotation of the upper molars can be observed to sustain the functionality in heavily worn teeth.

Cusps and basins in bunodont dentitions are predominantly regarded to be used for crushing food. During ontogeny the occlusal surface of bunodont teeth are flattened and badly worn teeth in older individuals give the impression of being dysfunctional. However, in some suids (e.g., *Sus scrofa*) and fossil proboscideans (e.g., *Gomphotherium*) the degradation of the cheek teeth opens up the possibility of functional changes. When the first molar comes in function the crushing area shifts distal and the deciduous fourth premolar with exposed dentine bordered by enamel margins modifies to functional shearing. Measurements in *Sus scrofa* show that the relationship between crushing surfaces and shearing edges remains almost constant in the dentition throughout a long period. The loss of crushing surfaces and afterwards shearing edges in the anterior region is compensated by the late eruption of the posterior second and third molars. Thus, the functional shift can be recognized from the anterior to the posterior region. The functional shift may indicate an evolutionary process to develop large or even hypsodont third molars as found in *Phacochoerus* while anterior teeth may be expelled. Furthermore, it favours the evolution of a horizontal tooth exchange as seen in some fossil and extant proboscideans.

Symposium B – Poster

Die Belemnitenschlachtfelder der Fränkischen Schwarzjura-Gruppe: Rostreneinsteuerung und paläoozeanographische Folgerungen

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Die Sedimentabfolge der Fränkischen Schwarzjura-Gruppe zeichnet sich durch einen Wechsel von (1) mächtigeren blaugrauen Tonmergeln bis Feinsandsteinen, (2) geringmächtigeren, teils kondensierten und phosphoritischen Kalken und Mergeln, und (3) bituminösen Mergelschiefern aus. Sowohl an Formationsgrenzen, als auch innerhalb derselben sind Aufarbeitungshorizonte entwickelt, darunter das sogenannte Belemnitenschlachtfeld an der Grenze Posidonienschiefer-/Jurensismergel-Formation. Neben Meeresspiegelschwankungen sind Wechsel im thermohalinen Meeresströmungssystem als steuernde Faktoren der lithologischen Wechsel, wie auch bezüglich der Genese der Aufarbeitungslagen selbst zu diskutieren. Bereits Urlichs [1971 Geol.Bl.NO-Bayern 21: 65-83] konnte für das bekannte Belemnitenschlachtfeld an der Grenze Posidonienschiefer-/Jurensismergel-Formation anhand der Belemniteneinsteuerung eine Bodenwasserströmung aus südwestlicher Richtung, also parallel zur Küste des vindelizisch-böhmischen Landes, feststellen.

In der vorliegenden Untersuchung wurde nun die Einsteuerung und Größenverteilung von insgesamt 1760 Belemniten aus diesem, wie auch drei weiteren Belemnitenschlachtfeldern anderer stratigraphischer Niveaus innerhalb der Fränkischen Schwarzjura-Gruppe, vermessen (Lokalitäten Grünsberg, Altdorf, Tiefenroth, Mistelgau, Reuth, Heng). Dabei belegen die Messwerte an einem schwachen Aufarbeitungshorizont innerhalb der Numismalismergel-Formation (Basis *stokesi*-Subzone) eine Bodenwasserströmung aus SSW. Dieser Horizont fällt mit dem Auftreten der im tethyalen Raum verbreiteten Ammonitengattung *Protogrammoceras* in Franken zusammen. Für die Grenze Numismalismergel-/Amaltheenton-Formation (Top der *stokesi*-Subzone) lassen mehrere unterschiedlich gerichtete Einsteuerungsmaxima der Rostren wechselnde Strömungsrichtungen bzw. ein Umstellen des Strömungssystems vermuten. Dieses fällt mit einem Wechsel der Ammonitenfauna von Protogrammoceraten, Lytoceraten und Phylloceraten zu einer durch Amaltheen geprägten borealen Ammonitenfauna zusammen. Für die Grenze Posidonienschiefer-/Jurensismergel-Formation kann die Einsteuerung der Belemnitenrostren durch eine erosive Bodenwasserströmung aus SW bis SSW bestätigt werden. Hier wird in Franken eine Ammonitenfauna, welche die boreale Gattung *Pseudolioceras* aufweist, von einer Grammoceraten- und Lytoceraten-dominierten Fauna (*thouarsense*-Zone) ersetzt. Innerhalb der Jurensismergel-Formation (Basis der *dispansum*-Subzone) zeigen sich Einregelungsmaxima, welche zwar küstenparallele Strömungen belegen, aber keine eindeutige Richtungsinterpretation zulassen. An diesem Horizont kommt es zu einem Wechsel von einer Grammoceraten- und Lytoceraten-dominierten

Ammonitenfauna (*thouarsense*-Zone) zu Ammonitenfaunen, welche die boreale Gattung *Pseudolioceras* enthalten (höheres Obertoarcium). *Pseudolioceras* kehrt somit nach einer Strömungsbedingten Pause wieder zurück. Die vorliegenden Daten stützen damit die Hypothese, dass mehrfache Wechsel des thermohalin gesteuerten Meeresströmungssystems zwischen Arktis und Tethys entscheidend das Sedimentationsmuster auf dem NW-europäischen Schelf zur Unterjura-Zeit mitprägten.

Symposium J – Vortrag/oral presentation

Teleostean diversity during the Jurassic and the origin of the crown-group Teleostei

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The Teleostei, represented today by over 27,000 species, are the largest, most diversified clade among vertebrates. Although there is consensus concerning the monophyly of the group, its definition and diagnosis are still problematic since its potential fossil sister group is still unknown.

The identification of Triassic and Jurassic fishes included in this study has been checked, many have been re-studied, synonyms have been revised, and recent findings have been incorporated into the analysis. Taxa with doubtful identifications or unclear ages are excluded. Databases have been built including taxonomic identifications, age and geographical distribution for each species. The results reveal that the rates of diversity change dramatically depending if the analysis concerns the stem-based (Teleosteomorpha), the apomorphy-based or the crown-based teleosts, but the age of the possible oldest teleosts does not change: Late Triassic for both the Teleosteomorpha (if pycnodontiforms and certain „pholidophoriforms" are interpreted as stem-based teleosts) or the apomorphy-based Teleostei (with *Pholidophorus latiusculus* at the base). From a modest representation (4 genera) in the Early Jurassic, apomorphy-based teleosts diversified and in about 50 million years were represented by +31 genera in the Late Jurassic. In the Early Jurassic members of the Leptolepidae have been recovered in Europe, Africa and South America. During the Middle Jurassic they reached their southernmost known distribution in the southern Antarctic Peninsula. In about 50 million years, teleosts proliferated mainly in marine waters, and at the end of the Jurassic they were living worldwide. During a long time it was believed that the extant teleostean lineages have risen during the Cretaceous; however, basal forms of the crown-group Teleostei or Teleocephala such as elopomorphs, ostariophysans and euteleosts have been recovered in Upper Jurassic strata. Among these, the oldest elopomorphs are from the lowest part of the Kimmeridgian and the ostariophysans from the upper Tithonian. Thus, in about 40 million years after the appearance of the first known „true" teleosts, the crown group made its appearance in the evolutionary history of Teleostei and diversified enormously during the Cretaceous, while most of the Jurassic basal teleosts became extinct during the Period.

Symposium C – Vortrag/oral presentation

Population structure of selected sponge species (Porifera: Demospongiae) from the Indonesian Archipelago

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Indonesia is an archipelago located in the Indo-West Pacific (IWP) centre of marine biodiversity. Its highly diverse coral reefs provide various habitats for marine invertebrates, including sponges. However, the Indonesian sponge fauna is insufficiently studied, which is a major disadvantage for marine area management in times of inceasing pressure on these resources due to global change. Studies on population connectivity from different habitats in the archipelago could provide important information for management efforts, e.g. by identifying genetically isolated areas that warrant special attention for conservation and management. The oceanography of the Indonesian archipelago is dominated by the Indonesian throughflow (ITF) currents, which influence marine larval dispersal among reefs. The current moves up to millions of cubic-meters of water per second from the Pacific to the Indian Ocean. Nevertheless, most sponges are supposed to have restricted larval dispersal, frequently resulting in limited gene flow. We examined genetic structuring between populations of selected sponges species in different habitats using mitochondrial and nuclear DNA-sequence markers. On a small spatial scale we focused on population-variation in the Spermonde Archipelago (SW Sulawesi) and on a large spatial scale we investigated populations from different sites throughout the Indonesian Archipelago. We also compared the genetic results with phenotypic differences, as populations in different habitats might have variations in phenotypes as well as genotypes. Studies of the phenotype included spicule morphometrics and skeletal architecture. Our aim was to contribute to the understanding of dispersal patterns and genetic connectivity among Indo-West Pacific sponges.

Symposium H – Keynote

Data Integration and Reconstructing the Mammalian Tree of Life

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Data from development and anatomy have resolved much of the deep structure of vertebrate life, including most major divisions within tetrapods as well as more superficial nodes

such as mammalian orders, families, and genera. On the other hand, confidence in our understanding of relationships among mammalian orders has required the addition of molecular data, leading to questions about the accuracy of phylogenetic work in paleontology, which generally has to work without molecular data. Here, I discuss combined morphological-molecular datasets sampling groups of placental mammals. Morphology contributes positively to clade support in a combined analysis, whether or not that clade is present in a tree derived from morphological data alone (a concept known as „hidden support"). Hidden support among African insectivorans, for example, shows that the addition of a morphological partition improves branch support for most nodes present in both the optimal MP and Bayesian topologies of a DNA-indel dataset, even though many clades are not present in the morphology-only analysis. Hence, we may be reasonably confident about the placement of fossil taxa for which no molecular data are available. Each part of the Tree of Life deserves scrutiny on its own, individual merits, and generalizations on the inadequacy of „morphology" for ordinal-level phylogeny reconstruction are unwarranted.

Symposium E – Keynote

Triassic gymnosperms, evo-devo, and the origin of angiosperms?

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Molecular phylogenetic analyses of the seed plants consistently indicate that extant gymnosperms and angiosperms are separate monophyletic groups indicating a long, unknown pre-Cretaceous history of a basal angiosperm linage. If this is correct, either some of the known Mesozoic and late Paleozoic „gymnosperm" seed plant groups are actually part of the angiosperm lineage, or the pre-Cretaceous basal angiosperms remain undiscovered. Several of the so-called Mesozoic seed fern groups have been implicated in this regard. Recently, the corystosperms have been suggested as angiosperm ancestors as part of the „mostly male hypothesis" in which a proposed homeotic mutation produces cupulate ovules on the adaxial surfaces of the microsprorophylls. The putative strength of this proposal is in providing homologs for the angiosperm outer integument and carpel, respectively. Based on more recent research on corystosperms from Antarctica and Asia, this hypothesis is refuted based on evidence for adaxial ovule attachment, as well as new developmental evidence from extant forms. Other candidates are considered, including a seed from the Triassic of North Carolina with dispersal hairs modified from lateral organs similar to those of several angiosperm groups. Although the „gymnosperm" group that gave rise to the angiosperms remains elusive, it is promising that molecular biologists and paleobotanists are now communicating and providing new insights into the morphology and evolution of extinct and extant gymnosperms.

Symposium H – Vortrag/oral presentation

The benefit of simultaneous analysis of molecular and morphological data – an example from Antilopinae (Bovidae, Cetartiodactyla, Mammalia)

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Despite the fact that Cetartiodactyla – even-toed ungulates including pigs, camels, deer, giraffes, cows, antelopes, hippos and whales – are well known to everyone, the phylogeny of this group is still under great debate, on high level relationships as well as within the groups. Antilopinae are one of the least understood groups of bovids (horned ruminants). They include the Antilopini and the „Neotragini" tribes, i.e. gazelles and other species living in open habitats and feeding predominantly on grass, specialized browsers as the Gerenuk, and some of the dwarf antelopes like the Dikdiks which live in pair territories and occupy more closed habitat. Neither molecular nor morphological analyses agree on a phylogeny of this group.

Using this taxon as an example I will show how much a simultaneous analysis can improve the phylogeny reconstruction, as both molecular and morphological data benefit from each other. Molecular data changes the optimization of morphological characters on the tree and therefore helps to overcome convergences. This can be seen in the grouping of „Neotragini", a polyphylum including all small antelope species. They form a clade when morphological data is analyzed alone, but separate into three different groups when molecular data is included. Morphological data, in addition to allowing the inclusion of species for which no sequence data is available, helps to resolve polytomies and greatly increases branch support, even though it makes up only a small portion of the complete data set. This becomes evident in a clade comprising eight of the former „neotragine" species, which is paraphyletic when molecular data is used but becomes monophyletic when morphological data is included. A well supported phylogeny of all Antilopinae genera (from molecular sequences of eight genes, morphological characters from skulls, data on chromosome rearrangements and behavior) was used to reconstruct ancestral body mass and territoriality of the most recent common ancestor of Antilopinae. The results challenge the traditional view that the dwarf species represent 'primitive' remnants of the first radiation of African antelopes. At least for the ones included in Antilopinae, their minute body size could instead be a derived feature.

Abstract **Balthasar et al.**, siehe S. 107

Abstract **Beierl & Rössner**, siehe S. 107-108

Symposium J – Vortrag/oral presentation

Postcranial skeletal pneumaticity in Triassic and Early Jurassic non-avian archosaurs and its implications for respiratory evolution

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Birds and crocodylians possess respiratory systems that allow unidirectional airflow through the lungs and it has been suggested that this ability might have been present in the common ancestor of all crown-group archosaurs (including birds, non-avian dinosaurs, pterosaurs, phytosaurs, aetosaurs and other crurotarsans). Unfortunately, the soft tissues of the lungs, bronchi and air sacs do not fossilize: nevertheless, air sacs are known to invade bone, leaving their traces as characteristic pneumatic fossae and foramina in the postcranial skeleton. The pattern and extent of this postcranial skeletal pneumaticity (PSP) can, therefore, be used to deduce the distribution of invasive air sacs (and thereby potentially avian-like respiratory systems) in extinct archosaurs. Here, we summarize the results of a project that used micro-CT scanning to investigate the presence/absence of PSP in all major Triassic-Jurassic archosaur lineages. Our results indicate that avian-like respiratory systems were present in non-avian dinosaurs and pterosaurs, although it remains to be determined whether air sacs were independently acquired in these two clades or whether they were symplesiomorphic for Ornithodira. Crurotarsans lack conclusive evidence of PSP, although some of these taxa possess features that might be correlated with the presence of non-invasive air sacs (shallow fossae bounded by prominent vertebral laminae). These observations suggest that the origin of the avian respiratory system might lie among archosaurs that are phylogenetically distant from birds, possibly in the common ancestor of ornithodirans. By contrast, current data indicate that extensive invasive air sac systems were absent in crocodile-line archosaurs, even if unidirectional flow was present. Both lineages apparently acquired their own respiratory specializations. Further work is needed to investigate the presence/absence of non-invasive air sacs in crocodile-line archosaurs, as this issue has major implications for establishing the primitive condition of the archosaur respiratory system.

Symposium B – Vortrag/oral presentation

Der Faunenwechsel bei Ammonoideen des mittleren Famenniums (Oberdevon III/IV) – Folge einer globalen trophischen Krise in Außenschelfen?

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In der klassischen Ammonoideen-Gliederung des deutschen Oberdevon ist seit langem ein deutlicher Faunenwechsel zwischen Oberdevon III (*Prolobites*-Stufe) und IV (*Platyclymenia*-Stufe) bekannt. Nachfolgende Bearbeitungen von Ammonoideen-Abfolgen weit getrennter Regionen verschiedener Kontinente (Ural-Asien, Nordafrika, Australien) zeigten, dass diese Trennung kein lokales Phänomen darstellt, sondern in (sub)tropischen Außenschelf-Regionen einem globalen Faunenwechsel und einem Aussterbeereignis entspricht, dass durchaus auch Auswirkungen auf andere Fossilgruppen der gleichen Habitate (z.B. Brachiopoden, Trilobiten) hatte. Detaillierte Untersuchungen zu den globalen *Annulata*-Events an der Basis des UD IV Europas und Marokkos (Hartenfels 2010) bestätigten, dass es sich um zwei kurzfristige, transgressive Eutrophisierungs-Ereignisse handelte, welche lokal unterschiedlich zu Blüten spezifischer, opportunistischer Organismen (z.B. Muscheln: *Guerichia, Loxopteria*, Clymenien: *Platyclymenia*, Goniatiten: *Prionoceras, Gundolficeras*) führten. Eine genauere Analyse zeigt, dass der Ammonoideen-Wechsel aber mitnichten mit dem Einsetzen C_{org}-reicher, O_2-armer Schwarzschiefer oder schwarzer Kalke zusammenfällt. In vielen Regionen (z.B. Kalifornien, Montana, Kattensiepen/Ostsauerland, Mähren, S-Portugal, Marokko: Meseta, Dra-Tal, Bulgarien, Iran, Karaganda-Becken/Kazakhstan, New South Wales) setzen fossilreiche *Annulata*-Eventschichten unvermittelt über Makrofossil-armen Sedimenten des prinzipiell gleichen, küstenfernen Ablagerungsraumes ein.

Untersuchungen von Profilen mit Faunen sowohl der *Prolobites delphinus*- (UD III-C), als auch der *Platyclymenia annulata*-Zone (UD IV-A) belegen durchgängig ein kurzes oder längeres Intervall völlig/fast ohne Ammonoideen, z.T. sogar ohne andere Makrofauna. Dies gilt im Rheinischen Schiefergebirge für seamount-Profile (Beringhauser Tunnel, Enkeberg) oder Knollenkalk-Folgen weiträumigerer Schwellenhänge (Ziegelei Nie, Reitenberg). Ähnliche Verhältnisse lassen sich für Franken aus Schindewolf (1923) entnehmen; neue Daten sind mangels von Aufschlüssen nicht verfügbar. Sowohl in der siliziklastischen Fazies des Maider-Beckens SE-Marokkos (Profil Mrakib), als auch in der stärker kalkig-mergeligen Fazies des Tafilalt-Beckens (Hassi Nebech), des Rheris-Beckens (El Gara), oder der zentralen Tafilalt-Plattform (Jebel Erfoud) werden Schichten mit *Sulcoclymenia* und *Platyclymenia* durch eine fast Fossil-leere Episode getrennt. Im Canning Basin NW-Australiens liegt eine Fossil-leere Zunge der basalen Piker Hills Formation zwischen der höchsten Virgin Hills Formation mit endemischen Prolobitiden und der durch Petersen (1975) bekannten Lage mit *Raymondiceras* und Platyclymenien. Für andere wichtige Regionen (z.B. Heiligkreuzgebirge, Algerien, Novaya Zemlya, Bashkirien) sind noch keine exakten Daten verfügbar.

Der Fehlen von UD III-C-Faunen in vielen Regionen und der graduelle Kollaps aller untersuchter Assoziationen am Ende der Zone, im Verein mit einem plötzlichen Aufblühen und einem Migrationsschub im Zuge der Eutrophisierung der *Annulata*-Events, sprechen dafür, dass eine global zunehmende trophische Krise, extreme Nahrungsarmut für Außenschelf-Cephalopoden bei zunehmender Regression, der Grund des Niederganges der frühen Clymenien-Prolobitiden-Faunen war. Ob eventuell Regionen in NW-Kazakhstan (Mugodzhar-Aktyubinsk-Region) ausgenommen waren, ist noch zu klären.

Symposium D – Poster

Fossile Rußtaupilze in mesozoischen und känozoischen Bernsteinen

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Epiphytische Pilze wurden in den letzten Jahren wiederholt in känozoischen und neuerdings auch in kreidezeitlichen Bernsteinen gefunden. Diese Fossilien gehören zu den sogenannten Rußtaupilzen (Capnodiales, Ascomycota), einer ökologischen Gruppe saprophytischer Pilze, welche fast ausschließlich Oberflächen lebender Pflanzen besiedeln. Viele Rußtaupilze beziehen ihre Nährstoffe aus Insektenexkretionen und leben zusammen mit Blattläusen, Schildläusen und anderen Produzenten von „Honigtau"; andere ernähren sich von Pflanzensaftausscheidungen. Rußtaupilze stellen sich als dunkler Belag auf dem Blattwerk oder der Rinde dar. In temperierten Regenwäldern machen diese Pilze einen beachtlichen Teil der Mycoflora aus und können neben Baumstümpfen, Ästen und Blättern auch Teile des Waldbodens bedecken. Das namensgebende Mycel der Rußtaupilze ist auffallend dunkel und bildet ein Geflecht (Subiculum) aus zumeist kugeligen und perlschnurartig aneinandergereihten Hyphen, die sich stark verzeigen. Dieses Subiculum zerfällt sehr leicht in einzelne Fragmente, welche der vegetativen Vermehrung und Ausbreitung der Pilze dienen.

Funde von in Bernsteinen konservierten Rußtaupilzen reichen vom Miozän bis in das Apt. Einige dieser Funde konnten aufgrund ihrer ausgezeichneten Konservierung im Bernstein verschiedenen Familien (Antennulariellaceae, Metacapnodiaceae) oder Gattungen (z.B. *Metacapnodium*) der Capnodiales zugeordnet werden. Die vielfältigen Funde kreidezeitlicher und känozoischer Rußtaupilze sind ein eindrucksvolles Beispiel für die morphologische Stabilität („evolutionäre Stasis") einiger Mikroorganismen, die, angepasst an ihre speziellen Mikrohabitate, ihren Habitus über mindestens 100 Millionen Jahre beibehalten haben.

Aufgrund der spärlichen Bernsteinvorkommen im unteren Mesozoikum bleibt die zeitliche Herkunft der Rußtaupilze unklar. Die zahlreichen Fossilbelege seit der späten Unterkreide dokumentieren jedoch ihre Präsenz in verschiedenen Wäldern der Erdgeschichte und lassen aufschlussreiche Informationen hinsichtlich ihrer paläogeographischen Verbreitung sowie ihrer Lebensweisen zu. So zeigen die Vertreter von Metacapnodiaceae aus dem Apt und Alb Spaniens sowie dem Alb Südwestfrankreichs, dass Rußtaupilze bereits in der Unterkreide in subtropischen Lebensräumen ausdifferenziert waren und dort assoziiert mit verschiedenen Pflanzengruppen wie Araucariaceae und Cheirolepidiaceae auftraten. Weitere noch unbestimmte Taxa subtropischer Lebensräume aus dem Cenoman Burmas wuchsen auf epiphytischen Lebermoosen. Mehrfache Funde in Baltischem und Bitterfelder Bernstein belegen ein Vorkommen dieser Pilzgruppe in warm-temperierten Lebensräumen des Eozäns und Oligozäns. Als Substrat kommen hier Fagaceae, Pinaceae und Sciadopityaceae in Frage. Vertreter der Familie Antennulariellaceae wurden in Dominikanischem Bernstein auf epiphytisch lebenden Lebermoosen der Gattung *Frullania* erhalten und belegen die Präsenz von Rußtaupilzen in miozänen tropischen Angiospermenwäldern.

Symposium K – Vortrag/oral presentation

Nachuntersuchung von *Nahecaris balssi* und *Palaeoscorpius devonicus* aus dem Unterdevon des Hunsrückschiefers

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Nahecaris balssi Broili, 1930 ist ein kleiner Phyllocaride (Crustacea) aus dem unterdevonischen Hunsrückschiefer. Im Rahmen einer kürzlich abgeschlossenen Studie wurde *N. balssi* anhand des Holotypus und 20 neuer Exemplare eingehend nachuntersucht. Das vergleichsweise seltene Vorkommen von *N. balssi* unter den Fossilien des Hunsrückschiefers lässt vermuten, dass dieser Phyllocaride gut schwimmen konnte und sich häufiger in der Wassersäule aufgehalten hat als am Grund. Das Tier war offenbar in der Lage, längere Distanzen über dem schlickigen Grund des Meeres mittels kräftiger Schläge der Pleopoden und des Abdomens zu bewältigen. Das Telson diente in Verbindung mit den Furcalstacheln als Paddel, welches durch die spezielle Form den Widerstand im Wasser erhöht und das Schwimmen zusätzlich unterstützt hat. *N. balssi* war ein Detritusfresser, der Futterpartikel oder vielleicht auch ganze Beutetiere mit hartem Gehäuse, wie kleine Schnecken oder Muscheln aufnehmen und zwischen den großen und kräftigen Mandibeln zerdrücken konnte.

Nach einer phylogenetischen Analyse von *N. balssi* und anderen paläozoischer Phyllocariden ist *N. balssi* ein Vertreter der Archaeostraca. Das Fehlen eines Rostrums und einer medialen dorsalen Platte lässt eine Stellung innerhalb der Echinocaridina vermuten. Weiterhin konnte ein möglicher sexueller Dimorphismus aufgezeigt werden, der sich anhand des Verhältnisses von Carapaxlänge zu - tiefe ermitteln lässt.

Aktuell wird *Palaeoscorpius devonicus* Lehmann, 1944, der nur durch den Holotypus bekannt ist, mittels computertomographischer Methoden neu untersucht. Im Gegensatz zu den meisten Hunsrückschiefer Fossilien ist dieser Skorpion beidseitig präpariert und mehr oder weniger dreidimensional erhalten. Seine Morphologie wurde früher von Lehmann (1944) und Kjellesvig-Waering (1986) untersucht, wobei einige Fragen nicht geklärt werden konnten. Insbesondere sind die Anatomie des Kopfes und die der Atmungsorgane weitgehend ungeklärt. Ob der Skorpion ein Landtier war und zufällig von den nahe gelegenen Ufers eingeschwemmt wurde oder ob er ein mariner Skorpion war, ist daher auch noch nicht geklärt. Erste Untersuchungsergebnisse zeigen, dass sich die Anatomie des Kopfes vermutlich von Kjellesvig-Waerings (1986) Rekonstruktion unterscheidet. Eine kleine laminierte Struktur am dritten preabdominalen Segment könnte der Schlüssel zum Verständnis der Atmungsorgane dieses Skorpions sein. Noch sind die Möglichkeiten der Untersuchung mit dem Computertomographen allerdings nicht ausgereizt. Erst weitere Tests werden zeigen, ob die Anatomie von *Palaeoscorpius devonicus* vollständig aufgeklärt werden kann.

Symposium A – Vortrag/oral presentation

Sequentieller Zahnwechsel und Mortalitätsprofil von juvenilen Nashörnern aus dem Miozän

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In der miozänen Fossillagerstätte Sandelzhausen (Obere Süßwassermolasse) bei Mainburg (Deutschland) sind die Rhinocerotidae unter den Großsäugern die weitaus häufigste Gruppe. Insbesondere für die kleinste vertretene Nashornart *Prosantorhinus germanicus* (Tribus Teleoceratini) fällt aufgrund von fossilen Milchgebissen unterschiedlicher Stadien und Knochen mit noch nicht verwachsenen Epiphysen auf, dass neben adulten Individuen auch viele Juntiere in der Lagerstätte vorhanden sind.

Die Kombination von morphometrischer, röntgenologischer und computertomografischer Analyse der fossilen Unterkiefer von *Prosantorhinus germanicus* lieferte detaillierte Informationen über die Zahnwechselfolge bei dieser ausgestorbenen, europäischen Nashornart und das relative Alter der gefundenen Individuen. Zum einen wurde die Kronenhöhe der Zähne sowie die Breite der Kaufläche gemessen, um den Grad der mit zunehmendem Alter voranschreitenden okklusalen Abnutzung zu bestimmen. Zum anderen wurden die juvenilen Mandibeln auf ihren jeweiligen Zahnwechselstatus untersucht, wobei auch die noch in der Anlage befindlichen Zähne mittels Röntgen und Computertomographie ermittelt wurden.

Das in 10 Entwicklungsstufen resultierende Mortalitätsprofil ergab einen deutlichen Peak im mittleren Bereich. Durch den Vergleich der Untersuchungsergebnisse mit Daten rezenter Nashörner wurden den Stufen im Profil Altersklassen zugeordnet. Hierdurch lässt sich dem juvenilen Stadium (1,5 bis 4 Jahre) eine erhöhte Todesrate zuordnen. Beobachtungen des Verhaltens heutiger Nashornarten weisen auf mögliche Gründe dafür hin, wobei Verfälschungen in der Fossilüberlieferung durch Transportvorgänge nicht außer Acht gelassen werden sollten. Im Allgmeinen müssen junge Nashörner das Muttertier nach etwa 2 bis 3 Jahren verlassen, wenn sich die nächste Generation ankündigt. Hierdurch sind die Jungtiere einer erhöhten Gefahr u.a. durch Predatoren ausgesetzt, da sie sowohl den Schutz der Mutter verlieren, aber auch noch nicht vollständig ausgewachsen sind (etwa 2/3 der adulten Körpergröße). Andererseits können auch Risiken verursacht durch direktes (Kämpfen) und indirektes (z.B. erzwungene Emigration in subotpimales Habitat) Sozialverhalten eine Rolle spielen.

Symposium H – Vortrag/oral presentation

Correlation between vertebral *Hox* code and vertebral morphology: implications for vertebral evolution in sauropodomorph dinosaurs

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Hox genes are of considerable importance in anteroposterior patterning of the body plan of invertebrates and vertebrates. Amongst the functions of this special family of homeotic genes is the specification of the shape of vertebrae. It has been proposed that a unique or highly distinctive axial *Hox* code (a combination of *Hox* genes) expressed in each somite specifies each of the different vertebral morphologies. The link between gene expression and vertebral morphology suggests that *Hox* genes may have played an important role in the evolution of specific axial variation.

Sauropodomorph dinosaurs are noteworthy for their highly complex and variable vertebral morphology and vertebral count. However, the exact mode and pattern of variation of vertebral count in sauropodomorphs is largely unknown. Thus, it is often uncertain whether additional cervical vertebrae, for example, represent new elements or dorsal vertebrae that have been incorporated into the cervical vertebral column. In the absence of other criteria, such as specific soft tissue associations, or genetic information, vertebral morphology is the only clue to resolve this issue. A distinction between cervical and dorsal vertebrae can be established, although there are usually one or two vertebrae which exhibit a transitional condition. With the use of 3D geometric morphometric analysis, we are able to objectively evaluate the morphology throughout the entire presacral axial column (excluding possible size effects).

Because morphological similarity seems to be directly causally related to *Hox* gene expression, the study of morphological variation as a proxy for *Hox* gene expression provides an opportunity to re-examine aspects of morphology in extinct taxa and address questions that have long been problematic for evolutionary biologists.

First, we will establish the *Hox* code for the formation of the presacral vertebral column in recent archosaurs and reconstruct

the ancestral *Hox* code for archosaurs on this basis. Second, we will test whether there is a direct linkeage between change in *Hox* gene expression and quantifiable morphology of presacral vertebrae in recent archosaurs. Third, we will try to establish *Hox* gene expression in fossil archosaurs, including sauropodomorphs, on the basis of quantifiable changes in morphology.

The analyses will not only give new insights into the development and evolution of axial patterning in archosaurs, but will furthermore represent an important case study of the application of principles of Evolutionary Developmental Biology in Palaeontology.

Freie Themen – Poster

Extraordinary abnormalities in Middle Devonian blastoids from the Rhenish Massif

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The Eifel region is now well known as a hotspot in echinoderm diversity during the Middle Palaeozoic. Within echinoderms, blastoids can be considered as an exception in term of stable morphology for the whole clade and of a clear underrepresentation in comparison to the other echinoderm groups (e.g., crinoids). Blastoids possess a tripartite endoskeleton, composed of a stem articulated to a globular to pyriform theca (enclosing viscera) with a five-fold symmetry and a developed food-gathering system of erect brachioles beard by ambulacra lying on the theca.

Recent field work has revealed an extraordinary rich fauna of blastoids from the Lower Givetian strata (Middle Devonian, hemiansatus Conodont biozone) of the Rhenish Massif (Germany). This new fissiculate fauna contains about 140 specimens of Hyperoblastus gilbertsoni showing various ontogenetic stages, 30 specimens of *H. acutangulus* and a possibly new species. The low pyriform theca of the *H. gilbertsoni* is composed of a short basal circlet (3 zygous basals), five radials and four deltoids. This relatively regularly skeletal features result in a uniform pentagonal outline of the theca. Our material solely includes isolated theca.

Within the *H. gilbertsoni* material, two specimens show different types of extraordinary abnormalities; both presumably occurring in the early growth stages. The two individuals, described herein, are the first abnormal blastoids known from the Rhenish Massif. The first specimen shows an aberrant hexagonal outline with six-fold symmetry. The thecal plating is modified with a small additional plate in each circlet (basals and radials). The exceptional feature of this specimen is visible in the A-ray of the specimen, showing a duplicated ambulacrum resulting in an overall number of seven ambulacra – a unique discovery among blastoids. The second specimen possesses a partially damaged theca with numerous atypical features, such as a shortened ambulacrum and a strong concave thecal deformation. The first type can be interpreted as a genetic anomaly. The second type obviously indicates a nonlethal injury resulting in a functional but imperfect „wound healing" regeneration.

Symposium E – Vortrag/oral presentation

Gymnosperm diversity in the Triassic of Antarctica: the enigmatic seed fern *Dejerseya*

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The Late Triassic has variously been referred to as the heyday of the gymnosperms. An important source of information on the anatomy, physiology, and botanical affinities of Triassic gymnosperms are the continental deposits of the Transantarctic Mountains. Although representatives of many Antarctic Triassic gymnosperm groups are today known in remarkable detail, there also exist a large number of enigmatic seed-plants whose affinities continue to remain obscure. One of these is the putative seed-fern foliage taxon *Dejerseya*, which is characterized by a simple architecture, entire to deeply lobed margin, and veins that form dense, fan-shaped groups. *Dejerseya* has a very chequered taxonomic history, and has previously only been reported from scattered occurrences in Australia, South Africa, and South America. We have identified a well-preserved, cuticle-bearing compression assemblage of *Dejerseya* leaves among a collection of plant fossils from the Upper Triassic of Mount Falla, central Transantarctic Mountains. The material offers the opportunity to clarify the status and delimitation of this ill-defined seed plant taxon. Moreover, associated with the leaves are fertile remains, including a cone-like male organ with *in-situ* pollen as well as a distinct type of dispersed ovule/seed. Although foliage fossils and reproductive structures do not occur in organic connection, these finds may provide important insights into the morphology and affinities of the enigmatic *Dejerseya* plant.

Symposium F – Vortrag/oral presentation

Die Großberg-Bank – eine neue Fundstelle für terrestrische Mammalia im Mainzer Becken am Übergang von MN1 zu MN2 (frühestes Miozän)

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Eine im Kalktertiär des Mainzer Beckens im Steinbruch Mainz-Laubenheim entdeckte Wirbeltierfundschicht mit ausschließlich disartikuliertem Skelettmaterial – die Großberg-Bank – enthält eine sehr umfangreiche Säugerfauna aus dem

frühesten Aquitan (Untermiozän). Zusammengetragen wurde diese durch Flüsse, die in die mit dem Oberrheingraben in Verbindung stehende brackische Mainzer-Becken-Lagune mündeten. Der hellgraue Hydrobienmergel der Fundschicht ist Teil der Unteren Oberrad-Formation (vormals „Oberer Teil“ der Oberen Cerithienschichten), die durch frühere biostratigrafische Untersuchungen an Kleinsäugern in die MN1-Zone gestellt wird. Die vorliegende Untersuchung bestätigt diese Einordnung und präzisiert sie auf Grund einer sehr fortschrittlichen Form der *Rhodanomys schlosseri* und der Koexistenz der Moschiden *Pomelomeryx* cf. *gracilis*, *Pomelomeryx* cf. *boulangeri* und *Amphitragulus* cf. *elegans* im Bereich der Großberg-Bank auf das oberste MN1 sehr dicht an der Grenze zum MN2. Dadurch ist die Grenze zwischen MN1 und MN2 in der Oberrad-Formation erstmals gut zu fassen und mittels korrelierbarer Profile auf das gesamte Mainzer Becken auszuweiten. Außer den genannten Taxa enthält die Großberg-Bank Marsupialia (*Amphiperatherium frequens*), Eulipotyphla (Erinaceidae, Talpidae, Dimylidae, Soricidae), Rodentia (Sciuridae, Castoridae, Gliridae, Eomyidae, Zapodidae), Lagomorpha (Ochotonidae), Perissodactyla (Rhinocerotidae), Artiodactyla (Cainotheriidae, Moschidae) und Carnivora (Amphicyonidae, Mustelidae), wobei jede Familie durch mindestens ein Taxon vertreten ist. Somit ist sie eine der vollständigsten Säugerfaunen aus dem oberen MN1 Deutschlands.

Freie Themen – Poster

Depositional environment and biofacies characterisation of Late Triassic-Early Jurassic continental deposits in Central Asia

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Detailed geological mapping in the type area of the Middle to Late Triassic Madygen Formation in SW Kyrgyzstan, Central Asia, is challenged by the separation of lithologically similar Mesozoic units. Especially problematic is a several hundred metres thick succession of fluvio-lacustrine deposits of Late Triassic to Early Jurassic age. Based on the depositional relationship of rocks, four units of formational rank can be discerned for this stratigraphic interval in the study area. From base to top these are the Madygen, Kylötok, Kamysh-Bashi, and Sogul formations. In total, 30 stratigraphic sections were measured and described in detail for the three older units in order to elaborate potential differences of these strata in terms of facies pattern and fossil content.

The up to 600 m thick Madygen Fm. is characterised by laterally and vertically extended lacustrine deposits being famous for their abundant and diverse fossil biota. Intercalations of fluvial deposits in the upper part of the formation consist of shallow 20-60 m wide northward trending channels with lateral sand sheets, which grade to silty floodplain deposits. The latter include hydromorphic rooted palaeosols, mudflows, and backswamp deposits exceeding one kilometre in lateral extent, despite a limited thickness of less than 0.5 m. Plant fossils are mostly preserved in overbank fines, while tetrapod remains seem to be restricted to channel fills and mudflows. The Kylötok Fm. is up to 43 m thick and, unlike the Madygen Fm., characterised by a more than 200 m wide and up to 10 m thick channel deposit, chiefly consisting of longitudinal gravel bars. The flow direction has been reversed to S-SSE. The floodplain deposits contain densely rooted hydromorphic as well as sparsely rooted moderately drained palaeosols. Rare plant fossils from up to 2.5 m thick backswamp deposits can be assigned to *Cladophlebis*, *Podozamites*, and *Taeniopteris* and represent a typical Late Triassic association. The up to 80 m thick Kamysh-Bashi Fm. is divided in two parts: The 50 m thick lower part is dominated by alluvial red beds with thin intercalations of fossiliferous pond deposits (conchostracans, insects, invertebrate and vertebrate trace fossils). The 30 m thick upper part contains a 110 m wide fluvial channel with an E–ENE palaeoflow direction and lateral sand sheets that grade to proximal floodplain deposits with abundant plant detritus and moderately developed hydromorphic paleosols. A 6 m thick backswamp deposit is rich in well-preserved impressions of fertile and sterile fern foliage (*Dictyophyllum*, *Phlebopteris*, *Eboracia*, *Todites*, *Cladophlebis*, *Coniopteris*) as well as foliage, cones, cones scales, and isolated bracts of conifers (*Podozamites*, *Drepanolepis*, *Schizolepis*, *Cycadocarpidium*). This assemblage is remarkably similar to the Rhaeto-Jurassic floras of Iran and Afghanistan.

In summary, the three formations studied in more detail are different in some respects at least. E.g., the Madygen Fm. yields the presumably oldest and the Kamysh-Bashi Fm. the apparently youngest flora. Well-sorted fluvial deposits are missing in the Madygen Fm., whereas the Kylötok and Kamysh-Bashi formations do not preserve extended lake deposits in the study area. Our preliminary results point to a general decrease of the palaeotopography and a slightly reduced availability of meteoric water from the base to the top of the discussed section.

Symposium A – Vortrag/oral presentation

Reconsideration of the chroniosuchian–crocodilian analogy on the basis of new morphological and osteohistological data

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Chroniosuchians are a group of basal tetrapods from the Permian and Triassic of Eurasia with a skull and vertebral structure that places them among basal stem-group amniotes. The alikeness of chroniosuchians and crocodilians was hinted for the first time by Boris P. V'yushkov in 1957 through the naming of *Chroniosuchus* – he alluded to its elongated snout

with the dentition of a carnivore, archosaur-like preorbital openings, and overall reptiliomorph appearance. Segmented dorsal shields, which were previously referred to kotlassiid seymouriamorphs, but correctly re-assigned to chroniosuchians during the 1960s, represent another prominent similarity. Chroniosuchian dorsal shields and those of many archosauriforms share the 1:1 alignment of shield segments and vertebrae as well as the connection of neighbouring osteoderms through joints. Given that chroniosuchian fossils often come from lacustrine to fluvial strata and in accordance with their supposed close relationship to embolomeres, earlier studies favoured the hypothesis that chroniosuchians were aquatic or semi-aquatic predators and represented ecomorphotypes similar to those hold by crocodilians and their relatives since the later Mesozoic.

For conclusions regarding chroniosuchian lifestyles we find the particular backgrounds of the formation of analogous dorsal shields in crocodilians and chroniosuchians worth considering: Unlike many representatives of the group, the ancestors of crocodilians were terrestrial animals and their dorsal shields formed part of a construction that evolved in the context of terrestriality. Similarly, the kinetic skulls of chroniosuchians and their dorsal osteoderm series – probably a device for the protection of the vertebral column and trunk by mitigating damaging loads associated with locomotion on land – have been suggested to be the heritage of land-dwelling ancestors. In agreement with a functionial analogy of chroniosuchian and crocodilian dorsal shields, the histological analysis of chroniosuchian osteoderms reveals distinct bundles of anteriorly and posteriorly trending Sharpey's fibres in the internal osteoderm cortices of four sampled taxa, confirming the attachment of epaxial muscles to the medial part of the ventral osteoderm surfaces – just as in the crocodilian trunk bracing systems. Regardless of this indication for a terrestrial capability, morphology and bone histology of the osteoderms suggest that the question of chroniosuchian habitat preference and lifestyle has yet no simple answer: A distinctly shaped osteoderm-osteoderm articulation effected a higher lateral flexibility in the dorsal shields of some Triassic chroniosuchians, implying that they were more capable of axial swimming than their ancestors. In agreement with an ecological differentiation, measurements of the osteoderms' internal space document low compactnesses and the dominance of a trabecular middle region in some species, whereas others display a low degree of remodelling and an increased thickness of the compact cortical layers – remniscient of pachyosteotic and osteosclerotic states found in the endoskeleton and osteoderms of secondarily aquatic tetrapods.

Symposium J – Poster

Compactness analysis of tetrapod dermal bone

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The distribution patterns of unmineralized zones within fossil tetrapod bone can be assessed quantitatively – after digitalization of inner spaces from bone thin section micrographs – by means of parameters that define how percentages of bone/ inner space vary along a certain anatomical axis. Several studies on long bone compactness employing Bone Profiler, a software which derives center to surface compactness profiles, have demonstrated that recent and fossil tetrapods display a considerable variability in their compactness parameters which correlates with their known aquatic or terrestrial habitat preference. Thus life style inference from long bone compactness analysis is feasible for fossil taxa whose ecology is poorly known or ambiguous.

Apart from long bones, the tetrapod integumentary skeleton also displays a variation in the overall compactness and in the distribution of unmineralized zones which may depend on the lifestyle-related function of such a skeleton. However, for several reasons dermal bone is rather badly described by a measurement scheme that integrates over concentric osteoderm zones in order to derive a single center to surface compactness profile: (1) Dermal bone cross sections are normally far from being isometric and their compactness distributions can be strictly orientation-dependent; (2) large parts may not have formed initially through inward to outward accretion of primary bone by a periosteum, but through metaplasia; (3) developmental processes on the outer (superficial) surface and inner (visceral) bone surface often differ markedly, as indicated by the presence of an outer ornamentation relief. Thus we are describing the compactness variation of dorsal osteoderms (as examples for dermal bone) through ventral (inside) to dorsal (outside) sections with a predefined width of 5 mm instead of using center to surface profiles. The percentage of crystalline bone substance is assigned to each of several parallel osteoderm area increments of equal size, into which the 5-mm-wide sections have been subdivided. Only if a representative number of dorsoventral profiles for each sampled osteoderm and profiles from several osteoderms are considered, variation within a single osteoderm and intraspecific variation as disturbing factors can be reliably assessed.

In our preliminary approach we compare dorsal osteoderms from five chroniosuchian species to dorsal osteoderms of aquatic and terrestrial temnospondyls. Our results show that the overall compactness values and compactness profile parameters for the chroniosuchian osteoderms are highly variable, overlapping with those for both reference groups. Arguably chroniosuchians cover a range of lifestyles within the terrestrial-aquatic spectrum.

Symposium J – Vortrag/oral presentation

Mesozoic vertebrate diversity, sampling biases, sea level, and insights into the „common cause“ hypothesis

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Establishing patterns of diversification and extinction in deep time is one of the fundamental goals of analytical palaeobiology, but analyses of marine invertebrates show that strong correlations exist between sampling (e.g. rock outcrop area, worker effort) and observed diversity. These correlations suggest that our understanding of diversity patterns may be strongly biased by the nature of the fossil record. Ongoing debate focuses on the severity of these biases, how best to correct for them, and whether both sampling and diversity are driven by a third factor (e.g. sea level, tectonics): the ‚common cause' hypothesis. Work addressing these problems for vertebrates remains in its infancy. Here, we provide an overview of ongoing research into the relationship between sampling and observed diversity for dinosaurs, Mesozoic marine reptiles, and pterosaurs, and make detailed quantitative comparisons between diversity, sampling, non-marine and shallow marine area, and sea level in an attempt to test ‚common cause'. We find strong correlations between sampling and observed diversity regardless of methodological approaches (e.g. binning strategies, data transformations, use of alternative sampling proxies), but we demonstrate that these sampling biases show substantial temporal, taxonomic and ecological heterogeneity. Short term fluctuations in dinosaur and deep water marine reptile diversity/sampling are not correlated with sea level, falsifying some prominent ‚common cause' hypotheses. By contrast, the fossil record of shallow marine reptiles is correlated with shallow marine area, suggesting that observed diversity patterns likely result mainly from species-area effects driving 'true' ancient biodiversity. We discuss the implications of these results for understanding the broader picture of vertebrate diversification during the Mesozoic.

Abstract **Butzmann & Fischer**, siehe S. 108

Symposium F – Keynote

Long-term biogeographic and diversity patterns in the Miocene Iberian mammal record

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The Miocene mammal record of the Iberian Peninsula stands out as one of the most complete of the world. High-resolution data are available for several basins which have been continuously sampled for more than fifty years so a detailed assessment of the existing biodiversity and a study of the response of mammal faunas to Miocene changing climates are now possible. After a compilation of genus-level data for both micro- and macromammals of several Iberian basins three main features of the record are evident: 1) the rarity of genera endemic to the Iberian Peninsula; 2) the higher diversity of the Catalan coastal basins as compared to the inner peninsula ones; 3) the higher affinities with central European faunas in the Catalan basins. After statistical analyses it becomes clear that both large and small mammal diversity and distribution in the Iberian Peninsula is largely controlled by the climatically-induced dispersal of faunal elements from other European regions. As a whole the Iberian mammal faunas can be seen as a subset of central European ones and particular groups, such as rodents and insectivores, are never as diverse as they are at higher latitudes. Furthermore, there is a clear difference between the Catalan basins (such as the Vallès-Penedès basin) and those of the inner peninsula (such as the Calatayud-Daroca and Teruel basins), the former showing higher affinities with the central European faunas which result in a higher local diversity. Many mammal taxa that preferred warm-temperate forest environments never dispersed into the inner peninsula which was probably characterized by dryer climates likely with precipitation seasonality by the Late Miocene. Such large-scale biogeographical and diversity patterns seen in the Miocene Iberian mammal record closely match the present-day situation. Even though the climate, environments and composition of the mammal faunas have all changed markedly from the Miocene on the overall trend has remained virtually unmodified for at least more than 20 million years.

Symposium G – Poster

Possible microenvironmentally triggered bioturbation in the Upper Franconian Wattendorf Plattenkalk (Upper Kimmeridgian, Southern Germany)

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In regurgitate patches on bedding planes of laminated limestones from the Upper Kimmeridgian Wattendorf Plattenkalk, the oldest of the Solnhofen-type plattenkalk occurrences of southern Germany (23km northeast of Bamberg), microscopic trace fossils have been discovered. They indicate that burrowing micro-organisms colonized, for brief periods, parts of the otherwise anoxic and inhospitable sea floor which was surrounded by microbialite-sponge reefs.

The trace fossils consist of simple vertical to slightly sub-vertical tubes 100 to about 450 µm in length. They are restricted to the top of the regurgitates, reaching down from the sediment-water-interface and are clustered in groups of occasionally more than 10 tubes. The distance between neighbouring tubes is around 20 µm. All tubes have a similar diameter of 30-40 µm, but the diameter is slightly reduced towards the lower end of the tubes. In addition, under the scanning electron microscope rare horizontal tubes can be seen, connecting the vertical tubes and thereby forming very simple networks with rectangular meshes. Also under SEM, the tubes exhibit a homogeneous lining. These wall structures with a mean thickness of about 1 µm seem to have stabilized the hollow tubes inside the soft regurgitate, which later on became filled by micritic grains, which are larger than those of the surrounding sediment. The linings, together with the rare tube networks and the tube infill of coarser sediment are evidence that the structures observed indeed depict some sort of bioturbation and not some abiotic sedimentary process within the regurgitate.

We assume that the organic-rich and still soft mass of the regurgitate (the product of a nektonic organism) settled on the anoxic and possibly hypersaline sea floor. Providing a suitable short-term microenvironment, the regurgitate became infested by some kind of burrowing micro-organism until lack of oxygen and hypersaline conditions (less likely depletion of organic material) put an end to the colonization effort. As the system of tubes is restricted to the upper regions of the regurgitate it seems that suitable conditions for the burrowing organisms quickly ended before the regurgitate became totally bioturbated.

Symposium D – Vortrag/oral presentation

Early Cretaceous angiosperms from the palaeoequatorial region and their ecologic adaptations

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During the last decades many early Cretaceous angiosperm fossils have been discovered world wide, their highest diversity, however, seems to have been in the northern Gondwanan realm. The remains are either preserved as dispersed leaves, charcoalified flowering structures, and in rare cases as whole plants with sterile and fertile parts attached. The latter fossils are of great interest, especially when cellular structures are still visible.

In the Aptian Crato Formation of northeastern Brazil various basal angiosperms were discovered that belong to the Nymphaeales, Chlorantales?, Magnoliales/Laurales, monocotyledons and to basal eucotyledons (Proteales?, Ranunculids?).

Several of these taxa exhibit distinct adaptations: Among the magnoliales two taxa grew realtively small (semi)coriacious sheathing leaves. The magnolialian taxa also have glands in all organs (axes, leaves, tepals) that are considered to represent etherial oil cells. These characters are often found today in plants that live under (semi)dry and/or seasonally dry conditions. Furthermore, one monocot taxon seems to have had in its leaves strong conductive strands that enabled this plant most likely to resist collapse under water deficiency stress. This feature may point to a life style of some of the early angiosperms as ground cover at partly sunny sites. However, there existed also relatively large lobed (thin) leaves that may have been produced in shaded habitats close to riverine environments without water stress. Overall, the large variety of leaf size, shape and internal structures of these early angiosperms support the assumption that by the late Aptian flowering plants already grew in diverse habitats and had expanded into various ecological niches.

Symposium J – Poster

Revision of the holotype of *Rhadinosuchus gracilis* (Archosauriformes: Proterochampsidae) from the early Late Triassic of southern Brazil

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The Proterochampsidae includes a clade of non-archosaur archosauriforms recorded in Middle to Late Triassic outcrops of the South American Paraná Basin (Brazil) and Ischigualasto Villa-Unión Basin (Argentina). This lineage consisted of semi-aquatic animals bearing sub-triangular skulls in dorsal view with highly ornamented roof bones. The Late Triassic proterochampsids are represented by *Proterochampsa barrionuevoi* and *Chanaresuchus* sp. in Argentina and *Proterochampsa nodosa*, *Cerritosaurus binsfeldi*, and *Rhadinosuchus gracilis* in Brazil. Of these late proterochampsids, the most enigmatic is *Rhadinosuchus*, originally described by von Huene from the Zahn Sanga in beds belonging to the *Hyperodapedon* Assemblage Zone (Ischigualastian). The lack of further studies since its original description currently obscured its phylogenetic affinities and taxonomic validity. A reappraisal of the holotype of *Rhadinosuchus* has allowed the recognition of characters considered synapomorphic for Proterochampsidae, namely the presence of external nares located dorsally and posterior to the tip of snout and dermal sculpturing on the frontals and nasals consisting largely of sagittal ridges. *Rhadinosuchus* also exhibits a strongly elongated antorbital region representing more than 50% of the skull length, a condition recognized in „proterosuchids", phytosaurs, and proterochampsids among basal archosauriforms. A unique combination of apomorphies allows the distinction of *Rhadinosuchus* from other basal archosauriforms, including autapomorphic maxillae with a laterally inflatened anterior portion and sub-thecodont maxillary dentition, in which the alveoli are medially opened. Accordingly, we present here evidence supporting the taxonomic validity of *Rhadinosuchus gracilis* and its assignmet to Proterochampsidae. Thus, the alfa-taxonomic diversity of proterochampsids in the Late Triassic of Brazil reaches that recorded during the Middle Triassic of Argentina, which was traditionally considered as showing the peak of proterochampsid diversity. The current understanding of the group shows that the diversity of proterochampsids did not meagre towards the end of the Triassic, but the morphological diversity of the lineage increased in Ischigualastian times.

Symposium K – Poster

Disarticulated echinoderm remains from the Lower-Middle Cambrian transition of Morocco suggest early origin of mitrates (stylophorans)

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Disarticulated skeletal elements of echinoderms have been recovered from the lower–middle (Series 2-3) Cambrian transitional beds of Morocco (the „Micmacca Breccia" of the Lemdad Valley, High Atlas). The echinoderm fauna comprises the oldest known pelmatozoans with holomeric columnals, and the oldest cornute stylophorans. New exceptionally preserved bilaterally symmetrical ossicles have been studied through synchrotron radiation-based X-ray mictrotomography (SRXTM) carried out at the TOMCAT beamline of the Swiss Light Source (SLS, Paul Scherrer-Institut, Villigen, Switzerland). These ossicles can be interpreted as parts of a complex distal aulacophore (stylophoran appendage). Their external morphology (median furrow flanked by two lateral depressions on their upper side and aboral blade-like knobs) shows diagnostic characters of mitrate appendages. If this assignation is confirmed, the stratigraphic interval of mitrates will be significantly extended, as the previously oldest known occurrences were in the lower Ordovician. Moreover, this extended interval will be more congruent with the interpretation of stylophorans as basal rather than derived echinoderms. The material also gives new information about the biology of these early echinoderms. Stylophoran plates are constructed of a three-dimensional mesh, similar to the stereom of living echinoderms, which provides a reliable guide to the nature of the associated soft tissues. Through comparisons with modern echinoderm anatomy, the stereom microstructure of these new mitrate elements, revealed by SRXTM, gave unprecedented insight into mitrate functional morphology and palaeobiology.

Symposium H – Poster

Molecular phylogeny of glass sponges (Porifera, Hexactinellida): increased taxon sampling and inclusion of a mitochondrial protein-coding gene

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Despite their ecological, evolutionary, and geological significance, hexactinellids (glass sponges) are still one of the most understudied groups of sponges. Molecular approaches to reconstructing their phylogeny have only recently been

applied, and were exclusively based on ribosomal RNA genes (rDNA). Although the rDNA phylogeny appears reliable as it agrees well with morphology-based systems, it has not been tested so far with protein-coding gene sequences. Also, taxon sampling for certain groups is still poor, hampering insights into their evolutionary history. Here, we have included further species in molecular phylogenetic analyses of Hexactinellida, especially improving taxon sampling of the dictyonal, sceptrule-bearing sponges (Sceptrulophora), and also established an ~1.3 kb region of the mitochondrial cytochrome c oxidase subunit I (COI) gene as an additional phylogenetic marker. Single-gene trees from the nucleotide and amino acid COI alignments were largely congruent with the rDNA phylogeny, but suffered from poor bootstrap support for many nodes. However, inclusion of the COI partition improved resolution of the combined-analysis phylogeny. Our results confirm monophyly of clavule-bearing farreids (Farreidae) with a typical farreid dictyonal framework. In contrast, a close relationship of *Sarostegia* to this clade is rejected; instead, our results are consistent with an earlier classification of this genus in Euretidae. We also found further support for monophyly of Tretodictyidae and reciprocal paraphyly of *Aphrocallistes* and *Heterochone* (Aphrocallistidae). Among Lyssacinosida, our results suggest non-monophyly of Lanuginellinae (Rossellidae) and reject the previously proposed affinity of *Clathrochone clathroclada* (*incertae sedis*) to Leucopsacidae.

Symposium H – Vortrag/oral presentation

Glass, rocks and clocks: prospects and problems of molecular dating in hexactinellid sponges

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A molecular paleobiological approach integrating paleontology and molecular biology can help in reconstructing the evolutionary history of taxa with fragmentary fossil records or uncertain paleontological classifications, such as Porifera. However, so far this approach has not been applied extensively to any specific sponge group. Glass sponges (Hexactinellida) have been – and still are – important elements of the deep-sea benthos. They have often been involved in reef construction, in both deep and shallower water, through different periods of Earth's history. Although their fossil record, which dates back to the late Precambrian, is relatively rich, fossil information for some groups is sparse, important characters are often not preserved, and relationships between extant and extinct taxa are still poorly understood. Thus, a molecular paleobiological approach is highly desirable for a better understanding of the evolution of this important taxon. Here we use the most extensive molecular dataset assembled so far for Hexactinellida to date their clade divergence times, using fossil calibrations and modern statistical inference methods that do not assume a strict molecular clock. We compare our results to different interpretations of the fossil record, and discuss potential implications for our understanding of hexactinellid evolution. Finally, we discuss some problems with current molecular dating methodology, and point to areas in need of further research.

Symposium H – Poster

Evolution of dictyonal sponges elucidated by molecular paleobiology

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Several groups of glass sponges (Porifera: Hexactinellida; Neoproterozoic – Recent) develop rigid skeletons by fusion of six-rayed megascleres, so-called dictyonal frameworks. Dictyonal sponges have a relatively rich Mesozoic fossil record and were important reef-builders during that time. However, their Paleozoic record is poor, and in general, the taxonomically important loose spicules are rarely preserved. The most prominent extant group, the „Hexactinosida", is known since the Late Devonian and, after a preservation gap in the Carboniferous and Permian, began to diversify in the Triassic. Most hexactinosidans possess so-called sceptrules, which suggests monophyly of a Sceptrulophora taxon. The first certain sceptrules were found in Middle Triassic strata, whereas more ambiguous reports come from the Early Ordovician and even the late Cambrian. Here, we a) reconstruct the evolution of the different sceptrule variants on the basis of a molecular phylogeny, and b) use relaxed molecular clocks to test hypotheses about the interpretation of the hexactinellid fossil record with respect to the evolution of Sceptrulophora. Our analyses demonstrate the potential of a molecular paleobiological approach to elucidate the evolution of taxa with a gappy fossil record and poor preservation potential of important characters.

Symposium D – Vortrag/oral presentation

Metasequoia – eminent in the Arctic Tertiary of Svalbard and Ellesmere Island, but lacking in the Middle European Tertiary?

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Metasequoia Hu & W.C. Cheng is an eminent conifer in the Arctic Tertiary.

During an expedition in summer 2007 by the author a wood remain with the affinity to *Metasequoia* was collected from a mass accumulation in a moraine at Nathorstland from the Eocene Aspelintoppen Formation in the Central Tertiary

Basin of Spitsbergen/Svalbard and described as a new wood taxa, *Taxodioxylon vanderburghii* (Dolezych et al. 2010).

Another unique fossil assemblage, many „in situ" stumps and relics of trunks lying at their original position, was explored at Stenkul Fiord at the South of Ellesmere Island. The wood fossils were taken from Palaeogene coal-bearing sediments of the Upper Palaeocene to Lower Eocene Margaret Formation during the expedition CASE 11 in summer 2008. Wood anatomy of some of the woods is diagnostic for *Taxodioxylon* sp., which is related to modern *Metasequoia.*

Now it is in discussion if the anatomical features both of these Arctic *Taxodioxylon*-woods are so similar to have the same morphospecies in Ellesmere Island or if is the Canadian relic is so different to have to establish new a morphospecies. In the sense – to know which similar fossil plants grew at Ellesmere Island/America and in Svalbard/Europe – the palaeobotanical evidence supports plate tectonic reconstructions for the Palaeocene, suggesting that Svalbard and Ellesmere Island were close to each other.

Records of leaf remains of the morphospecies *Metasequoia occidentalis* (Newberry) Chaney (cones and twigs) associated with both fossil woods were found and were interpreted in the sense of the „Whole plant-concept".

The found taxa represent prominent constituents of the coal-forming vegetation in the Polar Broad-leaved Deciduous Forest. The vegetation of Paleogene/Neogene flora of high-latitude grew under the polar light regime.

In the Middle European Tertiary woods with the affinity to *Metasequoia* are only known by Schönfeld (1955) with *Taxodioxylon metasequoianum* Schoenfeld and by Greguss with *Metasequoioxylon hungaricum* Greguss (1967). Many palaeobotanists have been questioned the existence of *Metasequoia* in European Tertiary because of the lack of other morphoorgans, only Zalewska (1953) has been reported from other fossil *Metasequoia*-organs. The answer to that question may provide a re-investigation of the taxa that fossil *Metasequoia* has been assigned as well as searching for new fossils of that conifer.

Symposium D – Vortrag/oral presentation

Peronosporomycota (Oomycota) in the fossil record

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Peronosporomycota (Oomycota) are fungus-like, straminipilous microorganisms in aquatic and terrestrial environments; many forms are economically important as disease causative agents. Although Peronosporomycota probably occurred on Earth as early as the Precambrian (>550 Ma), the fossil record of the group has remained poorly documented. It is generally assumed that this paucity of evidence is due largely to the poor preservation potential of these organisms. Moreover, the characteristic oogonium-antheridium complexes in fact represent the only structural features that can be used to positively identify fossil peronosporomycetes. This talk reviews the fossil evidence of peronosporomycetes that have been identified based on oogonium-antheridium complexes. Moreover, it reviews a number of problematic microfossils that have variously been assigned to this group of organisms as well. The fossil oogonium-antheridium complexes indicate that Peronosporomycota are preserved in certain rocks and may be more frequent in the fossil record than previously believed. The scarcity of descriptions of fossil peronosporomycetes appears to be related, at least in part, to difficulties in finding these organisms, rather than to their actual absence or lack of preservation potential.

Symposium A – Vortrag/oral presentation

Die Paläobiologie der Tentakuliten des Hunsrückschiefers

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Seit Tentakuliten das erste Mal 1775 in der Zeitschrift „Der Naturforscher" erwähnt und abgebildet wurden, herrscht viel Spekulation über ihre systematische Position. Sie wurden als Trilobitenstacheln, Brachiopoden- oder Crinoidenteile und Polychäten betrachtet. Schließlich fanden sie eine Einordnung bei den Mollusken und nach einigen Ansichten gehören sie zu den Cephalopoden. Ihre stratigraphische Bedeutung ist seit rund 60 Jahren bekannt, aber ihre Lebensweise blieb auch weiterhin Gegenstand von Diskussionen. Paläobiologische Interpretationen zur Lebensweise der Tentakuliten sind genauso breit gefächert und oft widersprüchlich wie ihre systematische Zuordnung. Anhand neuer Stücke aus dem unterdevonischen Hunsrückschiefer ist es nun möglich eine präzisere Aussage über ihre Lebensweise zu treffen: Die bisher nie in Zweifel gezogene, pelagische Lebensweise der kleinwüchsigen Dacryoconariden kann widerlegt werden. Zudem gibt es deutliche Hinweise für Kommensalismus und Aasfressen. Sowohl die von Blind und Stürmer (1977) postulierte Weichteilerhaltung von Dacryoconariden des Hunsrückschiefers, als auch die von ihnen postulierten Opercula sind nicht haltbar. Bei den sogenannten Weichteilen handelt es sich um verdrückte Schalenteile, bei den Opercula um juvenile Muscheln oder Brachiopoden. Dies wird anhand von dreidimensionalen CT Aufnahmen untermauert. Weiterhin wurden röhrenförmige Ansammlungen von Dacryoconariden untersucht, die den Schluss zulassen, dass Polychäten gelegentlich kleine Tentakuliten zum Bau ihrer Wohnröhren verwendeten, wenn ihnen kein anderes Material zur Verfügung stand.

Symposium B – Poster

Phyletischer Gradualismus bei Beloceratiden (Agoniatitida, Gephuroceratacea) des tiefen Oberdevon?

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Die Fossilüberlieferung ist meist zu unvollständig, um Phyletischen Gradualismus bei Makrofossilgruppen zu belegen. Die Anzahl gut dokumentierter Fallbeispiele, vor allem des Paläozoikums, ist gering. Devonische Ammonoideen sind aufgrund ihrer fossil gut erhaltungsfähigen Gehäuse, welche oft die Phylogenie ontogenetisch rekapitulieren, ihrer weiten Verbreitung und Häufigkeit in Außenschelf-Sedimenten und ihrer hohen biostratigraphischen Präzision grundsätzlich ein entsprechendgeeignetes Forschungsobjekt. Jedoch gibt es auch bei ihnen nur wenige Gruppen mit klaren Entwicklungstrends und relativ kontinuierlichen Faunenabfolgen über längere Zeiträume hinweg. Dies trifft für die Beloceratidae des mittleren und oberen Frasniums zu, deren graduelle extreme Suturkomplikation und Änderungen von Gehäuseparametern parallel in zeitgleichen und weit getrennten Gebieten analysiert werden kann.

Untersucht wurden zunächst Beloceratiden-Sequenzen aus dem Canning Basin von NW-Australiens, wo reichhaltige Ammonoideen-Faunen zwischen 1989 und 1996 in der Aussenhang-Fazies (Virgin Hills Formation) der tektonisch fast unverstellten großen Riffkomplexe gesammelt wurden (z.B. Becker et al. 1993; Becker & House 1997, 2009). Die ältesten untersuchten Formen fallen in das höhere Oberdevon I-G (*Mesobeloceras housei*), die jüngsten (*Beloceras* sp.) in das höchste Frasnium (tiefe MN 13b-Conodontenzone) bzw. aus Äquivalenten des oberen Kellwasser-Horizontes Europas. Die *Mesobeloceras*-Sequenz ist nur episodisch erhalten, während Vertreter von *Beloceras* in neun sukzessiven Zonen/Subzonen verschiedener Fundpunkte vorkommen. Umfangreiche Conodonten-Daten sichern die Datierung aller Faunen zusätzlich ab. Die exakte morphometrische Analyse umfasst Änderungen der relativen Nabelweite (Nw/Dm), dass Verhältnis von Windungsbreite- und höhe (Wb/Wh), das Verhältnis von Nabelweite und Windungshöhe (Nw/Wh) und die Anzahl von Ventral- und externen Umbilicalloben bzw. ihr Verhältnis bei spezifischen Durchmessern bzw. Wh-Werten. Die bisherigen Daten bestätigen eine stetige Abnahme der Nabelweite innerhalb von *Mesobeloceras* und *Beloceras*, jedoch bleibt bei wenigen Exemplaren des Oberdevon I-J ein relativ weiter Nabel erhalten. Die adulte Zahl der Externloben steigt von 3.5 im I-G2a, auf 4.5 im I-G2b, auf 6-7 im I-H, auf 7.5 im I-I2 und auf 8 vom I-J an, gefolgt von einer Stagnation dieser Entwicklung bis zum Aussterben der Linie am Ende des Frasniums. Gleichzeitig erhöht sich symmetrisch die Zahl der externen U-Loben. Eine zusätzliche Einschaltung kleiner U-Loben charakterisiert das seltene *Idiobeloceras* des hohen Oberfrasniums bzw. einen plötzlichen morphometrischen Wechsel in einer abzweigenden Seitenlinie. Eine weitere Seitenlinie wird durch eine seltene Form mit aufgesetztem, scharfen Hohlkiel vertreten.

Fortlaufende Untersuchungen werden zeigen, ob die morphometrische Entwicklung zeitgleicher marokkanischer Populationen identisch verlief, oder ob die weite geographische Trennung innerhalb der Prototethys den genetischen Austausch einschränkte. Gleichzeitig wird es möglich sein, isolierte Beloceratidenfunde des Iran, des Rheinischen Schiefergebirges, Belgiens und S-Frankreich in die Gesamtentwicklung einzupassen.

Symposium K – Vortrag/oral presentation

Cambrian trace fossils from the north-eastern Africa – Middle East segment of Perigondwana

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The Cambrian depositional history in the today north-eastern Africa and the Middle East part of Perigondwana is characterized by short-time discontinuous flooding of the Panafrican basement and subsequent regression. Whereas in the central-northern (Libya, Egypt) and north-eastern Africa (Egypt, Sinai) segment of Perigondwana this evolution is indicated by siliciclastic marginal-marine successions, related suites of the palaeolatitudinal lower situated Middle East (Jordan, Turkey), in contrast, yield carbonate sediments, too. So, the fossil content especially of the siliciclastics portions is valuable for comparative investigation of palaeoecological and palaeogeographical aspects and for a stratigraphic frame of the related depositional processes.

For the first time trace fossils others than simple *Tigillites* (*Skolithos*) or non-identifiable „bioglyphs" are reported here from central-northern Africa (Al Qarqaf Arch, Libya). From the Cambrian Hasawnah Fm. first findings of *Rusophycus*- and *Cruziana*-type trilobite traces indicate an age not older that higher early Cambrian for these marginal-marine sediments following a basal conglomerate which overlays the Proterozoic (Cadomian consolidated) basement. The sedimentary succession represents the transition from probably fluvial to deltaic, to tidally influenced, and finally to short-time shallow subtidal deposition, related to sandbars. The mentioned trace fossil assemblage is rather scarce in diversity and indicates short marine impulses within rather proximal position than a major transgression event.

Farther north-east (Eastern Desert of Egypt and Sinai Peninsula) findings of *Cruziana aegyptica* point to a similar higher early to early middle Cambrian age. Probably, the Libyan traces do also belong to this ichno-genus (taxonomic investigation in progress). Numerous simple trace fossils („worm-like") typically occur together with *C. aegyptica*. The Egyptian strata, also similar in their depositional facies, may be correlated with the fossiliferous levels of the Libyan Hasawnah Fm. In contrast, traces reported from different Egyptian assemblages and places

(including *C. salomonis* and others) seem to be slightly younger.

In the Middle East region (Jordan, Turkey) the Cambrian intermezzo yields not only marginal-marine siliciclastics, but also datable fossiliferous carbonate suites. Extensive investigation of the ichno-fauna of the siliciclastic Hanneh Mbr. (Jordan) led to recognition of distinct assemblages related to special palaeoecological conditions. Both, the above mentioned *C. salomonis* and *C. aegyptica* are related to interbar and intertidal/tidal flat environments, whereas other assemblages (including *Planolites, Arenicolites, Diplocraterion, Diplichnites, Rosselia* and others) occur in subtidal shelf, sandbar and prodeltaic deposits. As in Egypt, both ichno-genera, *C. salomonis* and *C. aegyptica*, do not occur together on same slabs or in same localities. Related trilobite body fossils (*Enixus (Palaeolenus) ex. antiquus* and *Kingaspis campbelli* vs. *Redlichiops blanckenhorni, Tayanaspis (Realaspis) orientalis* and *Myopsolenites palmeri*) may support a slightly different biostratigraphic age of these ichno-levels near the series 2-3 boundary as already assumed from the Egyptian traces.

The *C. aegyptica* level (?basal series 3) seems to represent the maximum flooding of this segment of Perigondwana by the Cambrian sea and an usual correlation level.

Symposium C – Poster

Preliminary classification of corals sampled by Ernst Haeckel in the Indian Ocean and their significance for reconstruction and evaluation of the recent environmental development

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Ernst Haeckel (*16.02.1834 Potsdam †09.08.1919 Jena), the founder of the conception of ecology, sampled corals from tropical reefs during his scientific sea-expeditions to Sri Lanka (1881) and to Java-Sumatra (1900). His niece Ingeborg Haeckel (*08.01.1903 Sonthofen †07.11.1994 Murnau am Staffelsee) gave 17 of these objects to Schloßmuseum Murnau (district Garmisch-Partenkirchen, Bavaria, Germany). Five original inscriptions - concerning location and date - on labels signed by Ernst Haeckel strongly indicate the geographical provenance and the datum of sampling of the corals.

In a preliminary analysis, the families and some species of the Scleractinian and Non-Scleractinian* corals are as follows:

Fungiidae (Dana, 1846): *Fungia* sp. [Inv. Nr. 4846/524, 4846/526, 4846/534];

Acroporidae (Verrill, 1902): *Acropora* sp. [Inv. Nr. 4846/525, 4846/529, 4846/577, 4846/578, 4846/582];

Tubiporidae* (Ehrenberg, 1828): *Tubipora musica* LINNAEUS, 1758 [Inv. Nr. 4846/527];

Dendrophylliidae (Gray, 1847): *Dendrophyllia* sp. [Inv. Nr. 4846/528];

Pectiniidae (Vaughan & Wells, 1943): ?*Pectinia* sp. [Inv. Nr. 4846/530];

Mussidae (Ortmann, 1890): *Lobophyllia* sp. [Inv. Nr. 4846/531, 4846/581];

Faviidae (Gregory, 1900): *Favites* cf. *halicora* (Ehrenberg, 1834) [Inv. Nr. 4846/533],

Platygyra daedalea (Ellis & Solander, 1786) [Inv. Nr. 4846/579]; *Favia* sp. [Inv. Nr. 4846/580];

Trachyphylliidae (Verrill, 1901): cf. *Trachyphyllia geoffroyi* Audouin, 1826 [Inv. Nr. 4846/532];

In physical science corals serve as environmental archivs: Geochemical data fixed during the biomineralization processes forming the lime-sceleton are used as palaeoenvironmental proxies, concerning the point-related trends of sea surface water temperature and salinity. The corals sampled by Ernst Haeckel therefore contain subrecent signals produced by the environmental development at the western and eastern margins of the Indian Ocean. Depending on the different growth rates of the corals, geochemical signatures were fixed shortly before or during the starting phase of the global use of petroleum and natural gas for mobility and industrial production (1859). Together with coeval proxies, the data may help to better reconstruct and evaluate the effects of environmental development influenced by anthropogenic activity. Habitus and size as well as the microstructure of recent species influenced by the effects of the present environmental deterioration (e.g. rise of sea surface water temperature and acidity) can be compared with equivalent reference species from Ernst Haeckel's collection.

Acknowledgements: Many thanks to Dr. W. Werner (Bayerische Staatssammlung für Paläontologie und Geologie, LMU Munich) for his help to classify the corals of Ernst Haeckel's collection and to identify some of the species.

Symposium C – Poster

The stratigraphy of Langer Köchel (S-Bavaria, FRG): a deepening upward sequence at the Grünten Ramp of the Helvetic Carbonate Platform

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The study area - the hump Langer Köchel - is located in the district of Garmisch-Partenkirchen in the moorland of Murnau-Eschenlohe. The Helvetic units establishing Langer Köchel as well as their palaeogeographic and palaeoenvironmental context are reviewed. They are part of the Helvetic fold-thrust-belt present at the external margin of the Northern Calcareous Alps. The Helvetic depositional area occupied a part of the northern shelf of the Mesozoic Tethys, where the prominent element of the Helvetic Carbonate Platform developed from late Jurassic to early Cretaceous under tropical-subtropical conditions. According to currently favoured models, the platform demised and drowned after ca. 31 Ma because of climate change: the greenhouse mode was brought about by flood-basalt extrusions in Large Igneous Provinces, gas hydrate dissociation and enhanced production of oceanic crust.

The change in conditions of sediment deposition related to the progressive drowning of the Helvetic Carbonate Platform during the late early to late Cretaceous is well preserved in deepening-upward sequences in proximal as well as in distal positions. The latter occurred at the Grünten Ramp: the distal, outer shelf part of the Helvetic Carbonate Platform. Corresponding deposits are present at Langer Köchel:

The Drusberg Member (late Barremian) (<5m thickness)

consists of dark grey, thinly bedded and laminated marlstones containing occasionally pyrite-nodules. Macrofauna (*Hibolites* sp.) is rare; microfauna consists of foraminifera, e. g. *Conorotalites intercedens bartensteini*.

The overlying Grünten Member (early Aptian) (1-90m thickness) is composed of dark grey, laminated marlstone strata up to 1,3m, which alternate with grey to dark grey, party nodular and locally burrowed, marly, up to 70cm thick limestone layers bearing occasionally pyrite-nodules. The marlstone boundary stratum at the top contains a well preserved, benthic microfauna made up of foraminifera and ostracoda; *Conorotalites aptiensis* (Bettenstaedt) and *Berthelina intermedia* (Berthelin) hint at an early late Aptian age.

The Freschen Member (late Aptian - Albian) (110m thickness) follows upward with sharp erosive unconformity. It starts with a subunit consisting of coarsely grained, dark olive, grey to dark grey, medium to thickly bedded, calcareous, glauconitic, pyrite-bearing and slightly phosphatic quartz sandstone layers. The uppermost parts of the layers locally contain the ichnolites *Paleophycus* sp. and *Thalassinoides* sp.. Occasionally, up to 40 cm thick, light grey, often contorted layers and nodule strings consisting of coarsely grained and impure, bioclastic limestone are intercalated. In the middle third of this unit, fine to medium grained, laminated and/or massive, up to several dm-thick quartz sandstone layers prevail. The upper third of this succession is separated by several dark grey, up to 30 cm thick, silty to sandy marlstone strata. Several dm- to m-thick horizons consisting of sandstone pebbles and boulders occur. In addition, convoluted, cm-sized chert horizons are occasionally present.

The overlying Seewen Formation (Cenomanian - Campanian) consists of a 75cm thick matrix-supported conglomerate layer (interpreted as an equivalent of the Götzis Member), which is topped by <10 meters of light grey and brick-red, bioclastic marly limestone strata.

In summary, the deposits establishing Langer Köchel document the development during the drowning and blanketing of the distal part of the Schrattenkalk Reef by terrigenous clastics (Garschella turnover). The slightly dysoxic depositional conditions documented from latest Barremian to Cenomanian, which possibly correspond to OAE 1A and OAE 1B, recovered in the Santonian – Campanian, as can be deduced from the deposition of oceanic red beds. The units contain equivalents of the well known second order sequence boundaries SbA2 - SbA4.

Freie Themen – Vortrag/oral presentation

Functional and morphological changes in the molar morphology of early Hippomorpha

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During the diversification of dietary adaptations within mammals, teeth are modified and highly specialized according to their function. This change is accompanied by a change of the dietary spectrum. Due to the well documented fossil record of the Hippomorpha, the evolutive changes in their teeth are well known. In the early Hippomorpha a change within the brachydont teeth from bunodont to lophodont occurs. Here the general morphological changes in the upper molars are described and analyzed based on 3D surface models according to their efficiency in the process of mastication. Both investigated families, Equidae and Palaeotheriidae, show an increase of the mastication functions cutting and shearing over time at the buccal side. Lingually different morphological changes take place in the two families.

The increasing relevance of the buccal parts of the upper molars is shown by the emerging ectoloph, which implicates morphological changes enhancing the efficiency for the functions cutting and shearing at that part of the tooth. Compared to the functional precursor *Phenacodus* (Condylarthra), *Hyracotherium* (Equidae) and *Propalaeotherium* (Palaeotheriidae) as basal hippomorpha show slightly pronounced cutting and shearing edges at the buccal side. This trend is continued in derived forms of both families as e.g. *Anchitherium* (Equidae) or *Palaeotherium* (Palaeotheriidae), where this feature is strongly emphasized. Accompanied by this is the proceeding steepness of the mesostyle relative to the tooth base. The increasing steepness points to a cutting and shearing process that gains in efficiency, as steeper angles cut more efficient than blunt ones. Additionally, the relative surface of the buccal facets increases compared to the overall facet surface area of the teeth. The buccal facets of *Palaeotherium* and *Plagiolophus* as derived Palaeotheriidae show the clearest accentuation of buccal facets, taking almost 90% of the overall facet surface of the second molar. The derived Equidae such as *Mesohippus* and *Anchitherium* have values of about 65%, primitive forms such as *Hyracotherium* and *Propalaeotherium* about 50% and *Phenacodus* even under 50%. The functional distinction of the derived forms of the two families is possible, when observing the lingual side in addition. In the derived Equidae the lingual tooth base in general is less developed while the lingually located facets are steep and well developed. Facets facing the centre of the tooth, which are considered as classical phase II facets, are hardly pronounced. This suggests an increasing development of the function shearing at the lingual side. The steep facets perform a shearing process and simultaneously drain off vertical forces diagonally which are generated in the mastication process; a distinct tooth base as a counter bearing for strong vertical forces and apical wear is not necessary. In the derived Palaeotheriidae the morphological features show an oppositional picture: the lingual tooth base is strongly developed, whereas the lingually located facets are not, the facets facing the centre of the tooth in turn are well developed. Therefore this suggests that a crushing function is developed at the lingual side, possibly taking place in a second phase of the mastication process. The strongly developed tooth base acts as a counter bearing for strong vertical forces and increased apical wear, developing in the mastication process.

The results support a different dietary spectrum for the derived forms of both families. In contrast the basal forms, as *Hyracotherium* and *Propalaeotherium,* resemble one another functionally fairly and a reliable functional differentiation with the analyzed features is not possible. The data points to a similar dietary spectrum, consisting of a relatively soft herbivorous nutrition. The derived Equidae on the other hand,

Mesohippus and *Anchitherium,* appear to specialize on fibrous food as leaves, where cutting is of advantage. The derived Palaeotheriidae, *Palaeotherium* or *Plagiolophus,* seem to be capable of dealing with harder, compact food items, such as hard fruit, without wearing their teeth in a very fast manner. Both families increase the efficiency of their mastication process regarding to different specific functions.

Symposium H – Poster

Progress and workflow of the Sponge Barcoding Project

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Sponges are notoriously difficult to identify, especially fossil but also Recent ones. While can DNA can not be extracted from fossil sponges, DNA barcoding provides tools that facilitate species identification in Recent sponges. Successful species identification in turn then leads to the identification of diagnostic species-specific characters, which then might also be of use for the identification and classification of sponge fossils. The Sponge Barcoding Project (www.spongebarcoding.org) is the first worldwide barcoding project on any non-bilaterian taxon, and aims to cover the complete taxonomic range of Porifera. The Sponge Barcoding Database is the prime access point for DNA signature sequences together with information on conventional morphological taxonomic characters of sponges. This unique combination of sponge-specific conventional taxonomic information and their DNA signature sequences is crucial for the use on sponges and the distinguishing feature to all other DNA databases.

In its initial phase, the Sponge Barcoding Project currently constructs its backbone framework of DNA signature sequences primarily from specimens of the Queensland Museum (Brisbane, Australia), which hosts the largest sponge collection of the Southern Hemisphere. We present our DNA extraction-, PCR-, sequencing-, and data analysis pipeline for sponges as developed by our lab and report on the current status, progress and taxonomic coverage of the Sponge Barcoding Project.

Symposium H – Vortrag/oral presentation

Horny sponges and their affairs: On the phylogenetic relationships of keratose sponges

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Sponges (Phylum Porifera) are among the first metazoans to appear in the fossil record in the late Precambrian, and some of them have been attributed to the so-called 'Psammosponges' or ‚Sandsponges'. Those sponges apparently agglutinated detritic material to support their spongin skeleton, as in extant keratose sponges. However, those fossils are difficult to identify and interpret as they are devoid of primary mineral skeletons. The demosponge orders Dictyoceratida and Dendroceratida comprise keratose sponges, which are (mostly) devoid of their own (primary) mineral skeletal elements, but possess a skeleton of organic fibres instead. This paucity of complex mineral skeletal elements makes their unambiguous classification and phylogenetic reconstruction based on morphological features difficult for fossil and even recent taxa. Here we present the most comprehensive molecular phylogeny to date for the Dendroceratida and Dictyoceratida, and also the Verongida based on several independent mitochondrial and molecular markers. We validate the coherence of all classically (morphologically) recognized orders, families and subfamilies, discuss the significance of keratose morphological and chemotaxonomic characters and suggest the revised definitions for the classification of dendroceratid, dictyoceratid, and verongid higher taxa.

Symposium H – Poster

Assessing diversity and evolution of Lake Tanganyika's sponges using DNA barcoding

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The diversity, systematics and ecology of sessile invertebrates in ancient lakes, particularly sponges (Porifera), are poorly understood despite their likely pivotal ecological function as filter feeders. Because these animals require careful hand collection underwater, are often delicate to transport, and are perceived by some to be less charismatic than, for example, cichlid fish, there has been a dearth of work on sponges. This is compounded by challenges in fresh water sponge taxonomy for the non-expert due to the depauperate suite of diagnostic morphological characters. We have sought to redress this by a series of underwater surveys of sponge occurrence in the Kigoma region of Lake Tanganyika, coupled with collections for systematic study. We used a first pass morphological approach to categorize morphospecies and worked to link this with the established taxonomy. However, a means of molecular identification such as DNA barcodes will accelerate the process of unambiguous species identification and reveal cryptic species.

Here, we present preliminary results on molecular barcoding approaches on freshwater sponges of Lake Tanganyika, which provides first insight into lineage diversity and morphological plasticity of this group. This is part of the Sponge Barcoding Project (www.spongebarcoding.org), which is the first worldwide barcoding project on any non-bilaterian taxa, and covers the complete taxonomic range of Porifera. We also demonstrate that the barcoding approach not only facilitates the assessment of biodiversity, but also sheds light on evolution and radiation of sessile invertebrates in Lake Tanganyika.

Symposium J – Vortrag/oral presentation

A review of the macroevolutionary patterns involved in the early radiation of dinosaurs during the early Mesozoic

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The early Mesozoic witnessed the origin and early evolution of most modern vertebrate lineages, including that of dinosaurs. The first 30 millions of years of dinosaur history, during the Late Triassic, are viewed as an example of evolutionary radiation, but the involved macroevolutionary patterns and processes are subject of intense debate. Some authors claimed that the early radiation of dinosaurs followed an 'opportunistic model', in which the early evolutionary radiation of dinosaurs occurred in an empty ecospace cleared by two successive extinctions, during the mid-Norian and at the Triassic-Jurassic boundary. Nevertheless, new information recovered in recent years from the oldest known dinosaur assemblages, mainly from the Argentinean Ischigualasto Formation (late Carnian-middle Norian), lead to reexamine these ideas. Previous authors have found that dinosaur alfa-taxonomic diversity exhibited a continuous increase during the Late Triassic. However, these estimations were based on biased indexes. In order to reach to a lesser biased estimation, a preliminary equation has been developed taking into account corrections result of the A) number of areas (e.g. localities, formations) bearing taxa of the lineage of interest and the B) number of ghost lineages. Within ghost lineages, the B1) branching order (e.g. dichotomies/polytomies) in the phylogeny and the B2) number of areas bearing taxa that result in ghost lineages have been elements that provide further corrections to the equation. It was found through this equation that the alfa-taxonomic diversity of Dinosauria remained almost constant during the Late Triassic, i.e. before and after the mid-Norian extinction event, but a conspicuous increase is observed during the Early Jurassic. Furthermore, a diversification rate analysis was performed on an amniotan semi-strict supertree. This analysis found that the basal dinosaur phylogeny significantly departs from a stochastic branching model ($p<0.001$) and a significant branching shift is located at the base of Dinosauria ($p<0.05$), which was calibrated to have occurred previous to the mid-Norian extinction. Accordingly, the estimation of alfa taxonomic-diversity and analysis of diversification rate shifts indicate that the early radiation of dinosaurs had become previous to the mid-Norian extinction event and, thus, not in an empty ecospace contrasting with a strict 'opportunistic model'.

Symposium A – Vortrag/oral presentation

Oxygen isotopes from non-marine shark tooth enameloid – environmental and ecological implications for the Late Palaeozoic of Central Europe

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The biogenic fluor-apatite in shark teeth enameloid represents a reliable geochemical archive of the ambient water chemistry at the time of tooth mineralization because of its resistance against diagenetic alteration. Thus, the oxygen isotope composition of shark teeth provides information about the former hydrological cycle, the local palaeoenvironment as well as possible migration patterns of shark taxa. Remains of xenacanthid and hybodontid sharks occur in both marine and predominantly non-marine Late Palaeozoic deposits. Hence their palaeoecology is under controversial discussion. Because of the continuous tooth replacement in all sharks, their tooth $\delta^{18}O$ values can be used for the differentiation between marine or freshwater signatures in order to decipher a diadromous or stationary lifestyle

In the present study, the oxygen isotopic composition of teeth from several Late Carboniferous (Westphalian) to Early Permian (Sakmarian) inter- and perimontane basins in Central Europe referred to the xenacanthids *Orthacanthus* and *Xenacanthus* as well as to the hybodontid *Lissodus* was analyzed. In total, 124 analyses of tooth enameloid were done, mostly by single tooth measurements. The mean $\delta^{18}O$ values are 17.6±0.4 ‰ VSMOW for the Westphalian basins of the Bohemian Massif, 16.9±0.8 ‰ VSMOW for the Stephanian basins of Bohemia and eastern Germany, 19.3±0.5 ‰ VSMOW for the Stephanian Saar basin in western Germany, 19.3±0.7 ‰ VSMOW for the Stephanian Puertollano basin in southwestern Europe, 18.4±0.9 ‰ VSMOW for the Asselian Saar basin in western Germany, 18.3±0.4 ‰ VSMOW for the Asselian basin in Sardinia, and 17.2‰ VSMOW for the Sakmarian of the French Massif Central. Furthermore, teeth from the Kungurian of Texas provided mean $\delta^{18}O$ values of 21.8±0.9 ‰ VSMOW for a full-marine environment, which is in good agreement with published oxygen isotope data derived from Pennsylvanian conodonts of the U.S. Midcontinent.

The $\delta^{18}O$ values of teeth from most continental sites are fractionated by 3-5 ‰ relative to the signal of coeval marine deposits. This strong difference in $\delta^{18}O$ is indicative for tooth mineralization from freshwater. The low variability of tooth $\delta^{18}O$ values indicates that the xenacanthid and hybodontid tooth bearers occupied fluviatil to lacustrine habitats without substantial habitat migration. The mean $\delta^{18}O$ values recorded from the Stephanian Puertollano basin and Saar basin are less fractionated than the other ones. The high Saar values imply that the ambient water was evaporatively enriched in ^{18}O due to a warm and dry climate and sufficient residence time in the basin. Neither the lithofacies of the Saar basin, nor its palaeogeographic position, nor the variability of tooth-$\delta^{18}O$ in the analyzed material support the assumption of any marine influence. Similar values from Puertollano seem to be caused by the same effect since deposits have been pegged as typical lacustrine by the contents of organic carbon and total sulphur as well as by organic biomarker compound ratios. Furthermore, there is a noticeable difference of about 0.5–1.4 ‰ between teeth of *Lissodus* and xenacanthids from the same strata. This deviation might be the result of different habitat claims of both shark groups, but it could also be the consequence of taxon-specific isotope fractionation, which is unknown in extant sharks.

Freie Themen – Poster

First evidence of an Elasmosauridae (Reptilia: Sauropterygia) in a Geschiebe from the Campanian (Upper Cretaceous) of South Scandinavia

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Here we describe an isolated dorsal vertebra from a plesiosaur that was found in a Pleistocene Geschiebe from the Campanium of southern Sweden. The Geschiebe is a carbonatic cemented sandstone or an arenitic limestone with siliciclastic compartments, mostly clear angular quartz and well rounded glauconitic grains. Lithological studies reveal that it can be correlated with the „Köpinge" sandstone from the Ystad-Vomb area in southern Sweden (upper Lower Campanian and lower Upper Campanian). The vertebra is almost completely preserved. The centrum is 75 mm long and 80 mm high. The neural arch is 85 mm high and 57 mm long. The Prozessus spinosus is rectangular, but distally broken. On the basis of the morphology of the neural arch and the proportions of centrum, the vertebra can be identified as Elasmosauridae. For the taxonomic classification plesiosaur material from southern Sweden was examined.

Symposium A – Vortrag/oral presentation

When do dinosaurs become mature? – A case study on *Psittacosaurus* from the Lower Cretaceous in China

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The attainment of sexual maturity is a fundamental life history trait of all organisms, but almost nothing is known about reproductive schedules in non-avian dinosaurs. Previous studies on dinosaurs based on demographic data and the detection of histological ontogenetic stages and medullary bone suggest that sexual maturity was probably attained very early in life, before full adult size was reached. According to palaeontological data, however, the small ceratopsid ornithischian dinosaur *Psittacosaurus lujitunensis* from the Lower Cretaceous (Yixian Formation) in China appeared to be an exception. Histological and demographic studies seemed to show that the maximum life span was 11 years, but sexual maturity was not reached before 9 years of age. This pattern of late maturity and a short reproduction phase is very uncommon in amniotes so we decided to reanalyze the demographic data. On the basis of the survivorship schedule l(x) and the ontogenetic growth curve, the age-specific probabilities of dying q(x) were estimated using an optimization approach. An ontogenetic energy balance model was then developed on the basis of the assumption that a trade-off exists between growth and reproduction, and that the onset of sexual activity results in a decrease in growth rate. Both models show that sexual maturity must have been reached at 7 to 8 years in *Psittacosaurus lujitunensis*. The results were tested by estimating the necessary energy for the production of one egg per day, the clutch size and the resulting population growth.

Symposium B – Vortrag/oral presentation

Multiple reasons why the cephalopod taxon „Neocoleoidea“ is not monophyletic

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The cephalopod superorders Decabrachia (= Decapodiformes) and Vampyropoda (= Octopodiformes) are traditionally combined as „Neocoleoidea”. The idea of a monophyletic origin of the „Neocoleoidea” is therefore commonly accepted. The „presence of suckers” in both the Decabrachia and Vampyropoda has been considered to be the most important autapomorphy that supports the monophyly of the „Neocoleoidea”. This assumption implies that the presumed sister-group of the „Neocoleoidea”, the extinct superorder „Belemnoidea” (consequently paraphyletic too), do not possess functional suckers.

However, a belemnoid hook-bearing arm crown recently discovered from the late Jurassic (Tithonian) Limestones of Eichstätt (southern Germany) clearly exhibits one row of sucker imprints along each of the ten arms. The specimen unambiguously shows that the hooks are not rooted in the suckers. Instead, each sucker alternates with a pair of hooks. An inner circle in the centre of the sucker imprint can be interpreted as the opening of the suction chamber. Particularly the latter observation clearly suggests that these suckers were most likely functional.

Hence, the „Neocoleoidea” lost its most important autapomorphy. Apart from this, also the sometimes listed autapomorphies „presence of fins” and the „absence of nacre” are problematic. The „presence of fins” is rather an autapomorphy of the whole subclass Coleoidea and the „absence of nacre” might be easily subject to independent demineralization events, which are known to have happened several times in the evolutionary history of the Coleoidea.

From the embryological point of view, the monophyletic origin of the „Neocoleoidea” appears also improbable, because there are at least two transformational steps necessary to develop their respective, distinctly different types of arm crowns.

Whereas the earliest vampyropods can be derived from phragmoteuthidid belemnoids, the root-stock of the first decabrachians is still enigmatic.

According to these arguments and in the light of the principles of parsimony, the taxon „Neocoleoidea” is no longer maintainable.

Freie Themen – Vortrag/oral presentation

Environmental significance of *Corbulomima* concentrations: The Upper Jurassic Tereñes Formation of Asturias (northern Spain)

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The Kimmeridgian Tereñes Formation of Asturias (northern Spain) consists of metre- to decametre-scale coarsening-upward cycles. Generally, these cycles start with a thin shell bed of the free living oyster *Nanogyra virgula*, which is followed by dark-grey marly silt with numerous shell beds and pavements of the small, shallow infaunal bivalve *Corbulomima*. The cycles are commonly topped by sandstones with abundant dinosaur tracks, or else by marly fine sandy siltstone and fine-grained sandstone, bioturbated by *Rhizocorallium irregulare* and *Thalassinoides*. These successions represent asymmetric deepening-shallowing cycles and are best explained as resulting from the progradation of delta lobes in a protected

environment (?shelf lagoon). Detailed investigation of one of these cycles revealed the presence of thin gypsum layers, calcite pseudomorphs after gypsum crystals, and associated thin stromatolitic layers around 4 and 9 m above the base. These levels indicate inter- to shallow subtidal conditions and an arid climatic regime with reduced siliciclastic influx. Thus different climate states are recorded by the sediments: humid (documented by progradation of delta lobes) and arid (documented by sabkha-type to shallow brine-pool sediments). The abundant shell concentrations and the intervening more or less unfossiliferous sediments are thought to document yet another order of cycles i.e., high-frequency climatic oscillations of the sub-Milankovitch band.

Taphonomic analysis shows that the abundant mono- to paucispecific *Corbulomima* concentrations are parautochthonous and that the low species diversity reflects high stress conditions rather than selective transport or chemical sorting. Although high environmental stress can be identified relatively easily in the fossil record, its cause may be more difficult to decipher, especially when more than a single stress factor is involved. The fine-grained substrate, high pyrite and Corg content, and the presence of evaporate minerals suggest that three environmental parameters contributed to the stress level i.e., a soupy substrate, dysoxic conditions at the sediment-water interface, and salinity values deviating from fully marine conditions. This assumption is corroborated by what is known about the ecology of modern corbulid bivalves, which commonly are extremely eurytopic. Moreover the occurrence of *Corbulomima* in other Jurassic strata, which exhibit signs of brackish-water conditions, a soupy substrate, and possibly lowered oxygen conditions, also supports the conclusions.

Symposium F – Vortrag/oral presentation

Quantifying chewing efficiency of ruminant dental patterns – an approach using three-dimensional metrology systems

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The implicate difficulties using two-dimensional (2D) methods to characterize the complex three-dimensional (3D) morphology of occlusal geometries have been largely overcome by the application of newly available 3D techniques. Indeed, during the past 5 years a substantial development of the 3D engineering metrology has taken place. We implement the high precision, efficiency of automatisation and minimized levels of observer error offered by these engineering 3D tools to, strictly quantitatively, characterize functional occlusal structures of ruminant dentitions. The aims of this study are to: 1) test for the accuracy of this new method in discriminating functional traits correlated to the different physical properties of the food, and 2) expand our model to the whole post-canine tooth row in contrast to former works, which relied on the study of one tooth position only (M2). We generate digital 3D models of upper cheek teeth of nine extant species of bovids (Bovidae, Cetartiodactyla) representing well known dietary traits using a topometric digitisation system working with a fringe projection technique. An industrial 3D metrology software is employed to extract 3D linear, surface and volume parameters of the enamel and dentin components of the occlusal topography. Three main patterns regarding inner enamel ridge complexity along the tooth row reflect the species specific feeding strategy. This suggests the interpretation of the whole post-canine tooth row as a functional unit linked to the biomechanical properties of food items and efficiency in the chewing dynamics.

Symposium E – Vortrag/oral presentation

Neue Funde von fossilen Araukarien aus Utah und ihre Bedeutung für die Koniferen-Diversität in der oberjurassischen Morrison Formation

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Neue, noch unbeschriebene Zapfen aus dem Bundestaat Utah in den westlichen USA erweitern die Diversität von Araukarien und anderen Koniferen im oberjurassichen Fossilbericht Nordamerikas bedeutend. Obwohl *Brachyphyllum*-Zweige und Koniferenhölzer öfter aus der oberjurassischen Morrison-Formation beschrieben wurden, sind Koniferenzapfen viel seltener. Eine Ausnahme ist die kürzlich (Juli 2010) publizierte „whole plant"-Araukarie, *Araucaria delevoryasii* GEE, aus dem nördlichen Wyoming, die aus Samenzapfen, abgeworfenen Samenschuppen, vereinzelten Samen, Pollenzapfen sowie Zweigen und Ästen mit *Brachyphyllum*-ähnlichen Blättern besteht. Diese Pflanzenreste sind vor allem Kompressionsfossilien, bzw. natürliche Ausgüsse der größeren Äste; deshalb ist die innere Anatomie dieser Pflanzenorgane noch unbekannt.

In der Gegend von Hanksville im südlichen Utah wurden in der Morrison-Formation durch Privatsammler über Jahrzehnte mehrere neue verkieselte Zapfen geborgen. Die Zapfen sind entweder mit noch den rätselhaften, sogenannten „short shoots" (Kurztrieben) oder mit vielen verkieselten Holzresten assoziiert. Insgesamt gibt es neun neue Taxa von Zapfen, die alle Samen trugen; im Gegensatz dazu wurden keine Pollenzapfen gefunden. Basierend auf der Morphologie der Zapfen sowie der Zahl von nur einem Samen pro Samenschuppe gehören fast alle Funde zur Koniferenfamilie Araucariaceae. Diese Familie ist heute vor allem auf der Südhalbkugel verbreitet, obwohl sie ein Hauptbestandteil der Wälder des Mesozoikums auf der ganzen Welt war. Weitere Untersuchungen sollen die Details der inneren Anatomie der Zapfen sowie ihre Bedeutung für die Phylogenie der Araukarien aufklären.

Symposium I – Poster

Diagenetic alteration of fossil mammalian bioapatite detected by triple oxygen isotope analysis

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Palaeoclimatic studies that deal with the oxygen isotope composition of fossil mammalian bioapatite can only provide reasonable results if the samples are diagenetically unaltered. Up to now, only indirect chemical proxies have been used to verify the pristine oxygen isotope composition of fossil bone and tooth samples. Our new approach directly targets the oxygen isotope composition by means of triple oxygen isotope analysis (^{16}O, ^{17}O, ^{18}O) to identify diagenetic modifications of skeletal apatite.

In a plot of $\delta'^{17}O$ vs. $\delta'^{18}O$ (where δ' represents the linearised form of the δ-notation), fractionation of $\delta^{17}O$ relative to $\delta^{18}O$ in almost all chemical fractionation processes fits a linear function with a slope of ~0.52. This slope is characterised as the terrestrial rock fractionation line (TRFL). Vertical deviations from the TRFL (expressed as $\Delta^{17}O$) are well known in atmospheric gases (e.g. air oxygen) and result from mass independent isotope fractionation due to photochemical exchange reactions in the stratosphere (Bender et al. 1994; Thiemens et al. 1995). Modern air O_2 has a triple oxygen isotope anomaly of $\Delta^{17}O$ = –0.38‰ (Barkan & Luz 2005) in respect to the TRFL with a slope of 0.5250 determined from 290 single analyses of terrestrial rocks and minerals in our stable isotope laboratory.

In a recent study, we have demonstrated that the $\Delta^{17}O$ of air O_2 is transferred through inhaled air via body water to skeletal apatite of mammals (Pack et al., submitted). Laser fluorination analyses of recent mammals with body masses between ~2 g and ~5000 kg show that up to 40% of bioapatite oxygen derives from inhaled air O_2. The $\Delta^{17}O$ value decreases with decreasing body size. This is due to a higher proportion of oxygen derived from air O_2 in body water of small mammals. Large mammals obtain a proportionally higher amount of oxygen from drinking water and free H_2O in food, which have a $\Delta^{17}O$ value close to 0‰. A detailed oxygen mass balance calculation corroborates the observed data.

It is expected that diagenesis reduces the triple oxygen isotope anomaly of bioapatite and leads to a „terrestrial" $\Delta^{17}O$ value of 0‰. Therefore, the $\Delta^{17}O$ value of small mammal teeth and bones (with $\Delta^{17}O < 0$) can be used as direct proxy for the detection of diagenetic alteration of the phosphate bound oxygen. Comparison of $\Delta^{17}O$ values between skeletal tissues with different susceptibility to diagenetic alteration such as tooth enamel, dentine and bone reveals effects of diagenesis on the bioapatite oxygen isotope composition.

Here we present triple oxygen isotope data from fossil enamel, dentine and bone material of five Cenozoic rodent specimens. The samples originate from south German localities covering different taphonomic and sedimentary settings and span a time range from Middle Eocene to Miocene (Gehler et al., submitted). Implications of the triple oxygen isotope data for the diagenetic alteration of skeletal apatite and the potential of $\Delta^{17}O$ values as a new diagenetic proxy will be discussed.

Freie Themen – Vortrag/oral presentation

Fossils and the fractal properties of evolutionary rates: consequences for understanding the evolutionary process

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Natural selection is a process that takes place on a time scale of generations, generation after generation- for millions of generations, and millions of years. Morphology is limited by functional constraints. The interaction of morphological constraint and essentially endless time has a non-intuitive effect on resulting rates of change. What we see on longer time scales is not representative of rates of the evolutionary process on shorter time scales. Rates are ratios, and rates are dependent on their denominators as well as their numerators. Knowing this, we see that evolutionary rates are fractal, and rates scale with their denominators in interpretable ways. This is best appreciated by modeling.

The classic *Metrarabdotos* test for punctuated equilibrium claims that rates of change observed long-term over the history of a species are too low (slow) to explain rates of change observed on shorter time scales during speciation. However the real question is whether the rates observed within species lineages are sufficient to explain change between lineages when compared on the generation-to-generation time scale of natural selection. This is illustrated by quantifying change in species of the bryozoan genus *Metrarabdotos*. The rates observed in species lineages of *Metrarabdotos* are comparable to those quantified for change in fossil horses and many other paleontological and neontological case studies. The calculated short-term rates can easily explain change between lineages observed during speciation. As few as 15 successive generations are required to explain the differences observed between species of *Metrarabdotos*. The fossil record is sometimes punctuated by rapid change on short time scales, but at the same time the process of evolution, while fast, is also gradual, proceeding step-by-step, generation-by-generation through time.

In this and in other examples, we see that natural selection at ordinary rates produces change that is much faster than typically observed in the fossil record. This is a consequence of both the narrow range of morphological constraint and the essentially unlimited time in terms of generations over which change takes place.

Abstract **Girard et al.**, siehe S. 108-109

Symposium C – Keynote

Quaternary coral reefs as archives of environmental and climate change

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

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

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

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

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

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

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Symposium G – Poster

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

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

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

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

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

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

Symposium A – Vortrag/oral presentation

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

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

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

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

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

Symposium F – Vortrag/oral presentation

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

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

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

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

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

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

Symposium D – Poster

Die Paläoflora des Randecker Maar: Palökologie und Paläoklima

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

vulkanische Aktivität gebildeten Krater bildeten im Lauf der Zeit Maarseen und waren von einer Vielzahl von Tieren und Pflanzen besiedelt. Die Seesedimente des Randecker Maars enthalten neben Insekten, Gastropoden, Spinnen und einigen Wirbeltieren auch eine reiche fossile Flora mit Pflanzen, Samen, Früchten und palynologischem Material (siehe Poster Rasser et al., dieser Band).

Trotz der hohen Bekanntheit des Randecker Maars wurden bislang kaum interdisziplinäre Arbeiten durchgeführt: Eine der umfassendsten Arbeiten zur Makroflora stammt aus den 1960er Jahren. Publikationen mit aktueller Taxonomie, Klima-Analysen der fossilen Vegetation mit Ansätzen wie LMA (Leaf Margin Analysis) und CA (Coexistence Approach) sowie detaillierte palynologische Untersuchungen fehlen jedoch völllig.

Im Rahmen einer Dissertation soll eine klimatische Rekonstruktion des Untermiozäns erfolgen. Makrofloren, Pollen und Warven dienen dabei als Klimaproxies und werden hochauflösend analysiert. Die ersten Ergebnisse werden in der vorliegenden Präsentation dargestellt.

In weiterer Folge werden geochemische Untersuchungen weitere Hinweise auf Ablagerungsbedingungen und klimatische Gegebenheiten geben. Diese werden in Kooperation mit der Universität Tübingen durchgeführt. Diese Untersuchungen sollen einen Beitrag zur

Rekonstruktion der klimatischen und ökologischen Verhältnisse des Untermiozäns in Europa leisten.

Symposium C – Vortrag/oral presentation

Growth and carbonate production inside Cretaceous rudist reefs

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During the Cretaceous, rudist bivalves flourished in low-latitude, shallow marine, carbonate and mixed carbonate-siliciclastic environments yielding associations of significant lateral extent. Taxonomic diversity and density of settlement of these rudist associations depended on physicochemical conditions such as salinity, water depth, water energy, and sedimentation rate. In shallow-water or lagoonal platform environments, rudist associations were commonly dominated by a single rudist species, and they varied in extent, from dm^2-scale bouquets that contained a dozen to a few hundred individuals up to km^2-scale lithosomes that contained billions of individuals. Although taxonomic, stratigraphic, and sedimentologic aspects of rudist reefs have been studied extensively, growth rates and carbonate production capability of rudist populations, as well as their growth mode relative to the mobile sedimentary surface is still under discussion.

The use of quantitative data regarding internal paleoecological processes like reproduction and mortality rates, larval settlement and packing density reveals new insights to this topic as well as saisonality signals in sclerochronological profiles. In addition, exceptionaly preserved rudist reefs clearly show the geometries of a superstratal growth mode. Limiting factor for the most effective carbonate factory ever in Earth history was limited vertical accomodation space on low angle carbonate ramps during times of high frequency, low amplitude sea level fluctuations.

Symposium F – Poster

Ecomorphologie via Guild-Analysen an tertiären Carnivoren

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Guild-Analysen und ihre ecomorphologische Aussagekraft wurde schon früh mittels zwei Parameter (Körpermasse und Nahrungspräferenz oder Körpermasse und Lokomotion) getestet. Die Kombination aller drei Parameter konnte erfolgreich an Creodonten-Assoziationen angewendet werden und in weiterer Folge erprobte man diese Methode an oligozänen bis miozänen Carnivoren-Vergesellschaftunge (z.B. Taatsin Gol (Monglei), Candir (Türkei), Sandelzhausen (Deutschland)). Jetzt wurde das Datenset um Guild-Analysen aus dem Paläozän (Bridger Formation) und rezenten Habitaten (Serengeti, Iwokrama) erweitert. Jeweils zwei Gilden wurden mittels der Principal Componets Analyses (PCA) auf die Wertung der drei Parameter (Körpermasse, Nahrungspräferenz und Lokomotionstyp) getestet. So hat sich gezeigt, dass Körpermasse den größten Einfluß in der Differenzierung der Raubtiergilden hat, dicht gefolgt vom Lokomotionstypus.

Ein weiteres Ziel der Untersuchung war es die Evolution von ecomorphologischen Mustern in einem taxonfreien System zu testen. Dies ist von besonderer Bedeutung, wenn man paläozäne Fundstellen miteinschließt, in denen neben oxyaeniden und hyaenodontiden Creodonta auch Mesonychidae, Pantolestidae, Arctocyonidae und Didymoconidae zu den Raubtieren zählen. Die Ergebnisse belegen klar den Einfluß von Umwelt und Klima auf Carnivoren-Zusammensetzungen. Dieselben Umweltbedingungen aus unterschiedlichen Zeitebenen brachten zwar taxonomisch unterschiedliche Gruppierungen hervor, aber in ihrer prinzipiellen Belegung der ökologischen Nischen zeigten sie dieselben Muster.

Symposium I – Poster

Microstructural and crystallographic texture variations in marine carbonate shells

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We study the hierarchical structural organization of calcium carbonate exo- and endo-skeletons of marine organisms as well as the interlinkage of the organic and inorganic components within these biomaterials. In this paper we discuss as an exa-

mple the microstructural and textural features of the calcitic shell of the brachiopod *Notosaria nigricans.* Furthermore, we address specific textural features of brachiopod calcite biomineralization in the course of shell growth. Based on the size and morphology of calcite crystals the shell of *Notosaria nigricans* is structured into two main layers which each consist again of sublayers. The primary layer on the outside of the shell shows an outer sublayer composed of nanosized crystallites and an inner sublayer with micrometre sized crystallites. The primary layer is followed inward by a secondary shell layer composed of fibrous calcite crystals. Sublayers of the secondary layer are distinguished by an alternation of domains where the morphological axis of the calcite fibres run in different directions in the plane parallel (or up to 10° inclined) to the shell surface. While in the juvenile brachiopod we have only three sublayers with distinctly oriented fibres in the secondary layer, the adult brachiopod shows several sublayers. The preferred crystallographic orientation of both, the primary and the secondary shell layers is a strong fibre texture. Calcite c-axes are perpendicular (up to 22° subperpendicular) to the shell vault and rotate with the curvature of the shell. Accordingly, the calcite c-axis is perpendicular (to slightly inclined) to the morphological fibre axis. In juvenile as well as in adult *Notosaria nigricans* there is a slight inclination in c-axis orientation between the shell sublayers. It is remarkable that in juvenile *Notosaria nigricans* a true three dimensional crystallographic preferred orientation is present in the shell, while at a later stage of growth, in adult *Notosaria nigricans*, the texture looses most of its 3D ordering and becomes a 1D fibre texture. At the hinge of brachiopods shells restructuring is needed during growth, and here the texture becomes bi- or even multimodal.

Symposium A – Vortrag/oral presentation

Well-based stratigraphy and facies analysis of Early Miocene deposits in the North Alpine Foreland Basin (Upper Austria, Salzburg) in the context of global events

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Although in the focus of scientific investigation since the early 19th century, the discussion of Central Paratethys evolution in relation to global records is rather poor. The regional stratigraphic concept of the Central Paratethys is largely based on the biostratigraphy of benthic, often endemic species hampering a precise correlation to the international time scale. Alternative approaches to address this problem like sequence- or cyclostratigraphy have been widely ignored. Furthermore, with the exception of a few well-studied basins like the Vienna Basin, the paleoenvironmental evolution of the Central Paratethys is documented rather scrappy. Facies models are often derived from outcrops while continuous sedimentary successions from drillings are rare.

The North Alpine Foreland Basin (NAFB) comprises one of the main sedimentation areas of the Central Paratethys from Oligocene to Early Miocene. A project co-funded by the Rohöl Aufsuchungs AG (RAG) and the Commission for the Paleontological and Stratigraphical Research of Austria (Austrian Academy of Science) intends to provide a high-resolution analysis for three N-S-oriented wells from the Early Miocene (regional stages: upper Egerian, Eggenburgian, Ottnangian) in the NAFB. Based on the combined information from micropaleontology, geochemistry, well-log analysis and seismic images the outcome of the project will contribute to an improved age-model for the Central Paratethys with respect to the international time scale as well as it will reveal new insights on the paleoceanographic and paleogeographic setting in the NAFB.

The potential of this integrated approach for a refined stratigraphic concept is exemplary shown in the Early Miocene/ Eggenburgian Hall Formation. Biostratigraphy of foraminifers, dinoflagellate cysts and calcareous nannoplankton allows a correlation to the regional substages of middle-late Eggenburgian and the early-middle Burdigalian (nannoplankton zones upper NN2-lower NN3). Cyclostratigraphic data derived from gamma and sonic logs in a continuous basinal clay succession corresponds with a Burdigalian age and suggests an absolute time frame for deposition from c. 19 to 20 Ma.

Furthermore, facies models based on benthic foraminiferal assemblages and various geochemical proxies have been developed which reflect different bathyal and neritic paleoenvironments. In combination with seismic images, two sedimentary sequences within the Hall Fm. are proposed. Most likely these sequences correspond to the global Bur 1 and Bur 2 sequences.

Symposium B – Keynote

News and Thoughts on Monoplacophora: Their Role in Molluscan Phylogeny

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Since their discovery in 1957 extant monoplacocphorans (Tryblidiida: Neopilinidae and Micropilinidae) have always played a central role in considerations on molluscan phylogeny. Most attention is still given to the expressed seriality of several organ systems (shell muscles, gills, auricles, nephridia and gonads, lateropedal connectives), which has been interpreted either as a reduced annelid-like segmentation or as an independent multiplication among the early Mollusca. Most recently, molecular data suggest sister-group relationships with the Polyplacophora and thus challenge the Conchifera-concept (Polyplacophora and Conchifera as sister groups).

Recent investigations on *Micropilina minuta* (with four pairs of gills and nephridia but lacking a heart) by means of 3D-analysis of serial sections have confirmed and elaborated the concept of progenesis among the Micropilinidae. During tryblidian ontogeny seriality of gills and (partly) of nephridia and gonads is established from posterior to anterior and thus independent from true metamerism in annelids and arthropods. Comparative investigations on nephridiogenesis in basic molluscs suggest that molluscan nephridia are formed like those of annelids and that the most anterior nephridium in adult tryblidians is the retained larval (proto-) nephridium.

We also question the phylogenetic significance of the widely applied Tergomya-Cyclomya-concept. This is contradicted by the condition of mantle retractors and the high variability of shell shape in molluscs exemplified at the case of closely related patellogastropods.

The proposed sister-group-relationship between Polyplacophora and Tryblidiida („Serialia") is at least a misnomer, since seriality in both taxa has been established independently. From the morphological point of view the Conchifera-concept remains as a valid hypothesis for early molluscan evolution.

Freie Themen – Poster

Lepadomorphe Cirripedier als Epöken orthoconer Cephalopoden - Zum Schwimmgleichgewicht heteromorpher Ammoniten

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Lepadomorphe Cirripedier der Gattung *Stramentum* Logan, 1897 konnten in unterschiedlichen Fazies der Kreide (Alb bis Santon) Europas, Nord- und Mittelamerikas, Vorderasiens und Afrikas nachgewiesen werden. Von der bislang nur im Cenoman und Turon Europas (England, Irland, Nordwestdeutschland und Tschechien) nachgewiesenen Art *Stramentum* (*Stramentum*) *pulchellum* (Sowerby 1843) sind neben disartikulierten Skelettelementen auch artikulierte Skelette bekannt geworden. Zumeist liegen disartikuliert Platten des Capitulum oder Pedunculus vor, wie in den Schreibkreideablagerungen. In wenigen Ausnahmefällen sind jedoch artikulierte Skelette verbreitet, wenn die Stramentiden 1) Ammonitengehäuse bereits im Larvalstadium als Epöken besiedelten und von den Cephalopoden im Laufe ihres Wachstums überwachsen wurden, 2) wenn sie an heteromorphe Ammonoideen angeheftet in Sedimente vom Typ „Schwarzschiefer„ eingebettet wurden und 3) wenn die Einbettung rasch erfolgte. Aus der Schwarzschiefer-Fazies des höchsten Cenoman (Ammoniten-Zone des *Neocardioceras juddii*) von Lengerich (Nordwestdeutschland) wird hier erstmals ein Stramentide beschrieben, der einem Sciponoceraten, also einem heteromorphen Ammoniten mit orthokonem Gehäuse, orientiert aufgewachsen ist. Die Anheftung des Stramentiden erfolgte mit der Basis des Pedunculus. Aus der Orientierung des Cirripediers zum Ammonitengehäuse lässt sich eine horizontale Schwimmstellung des Cephalopoden ableiten, wie es bei heutigen Sepien der Fall ist. Die orientierte Anheftung der Cirripedier sowohl an planspiral eingerollten Ammoniten, als auch an dem Sciponoceraten sprechen dafür, dass sich der Cephalopoden nicht nach dem Rückstoßprinzip rückwärts, sondern vorwärts schwimmend bewegt haben muss.

Symposium B – Vortrag/oral presentation

The Triassic radiation of bivalves

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Although the diversity of bivalves steadily increased throughout the Palaeozoic, they remained minor constituents in most marine ecosystems until the beginning of the Mesozoic, when they became the dominant group of shelly filter feeders. This rise to dominance has been attributed to a superior bauplan that enabled bivalves to outcompete supposedly inferior groups such as brachiopods over geological time, or alternatively to the happenstance of the end-Permian mass extinction that affected bivalves less severely than most competing groups. New analyses of the extinction-recovery pattern confirm that bivalves were indeed less affected by the end-Permian crisis than most other benthic groups, and that their diversity exponentially increased during the initial recovery interval. However, competing groups were not decimated to the point where reoccupation of habitats became unlikely, and bivalves did not enter previously unoccupied niches during the Triassic. Rather, the Triassic radiation of bivalves was characterized by multiple evolution of traits that already existed in Palaeozoic bivalves. More precisely, supposedly „modern" life habits such as deep-infaunal burrowing, cementing, and swimming already evolved in Late Palaeozoic Pholadomyidae, Prospondylidae, and Entoliidae, respectively. The Mesozoic increase of these lifestyles took place by parallel evolution in different clades and was probably stimulated by increased predator pressure rather than by reduced competition. Important groups such as oysters and scallops evolved during this phase of bivalve evolution, progressively replacing Palaeozoic survivors that were adapted to comparable lifestyles. Towards the end of the Triassic, the diversity increase of bivalves progressively slowed down, reaching a plateau of ca. 100 genera at the end of the epoch. The fact that bivalve diversity increased again since the Jurassic is at least partly owed to the evolution of fused mantle margins in heterodonts, which enabled them to diversify in deep infaunal habitats. In conclusion, reduced competition in the wake of the end-Permian mass extinction had an important impact on the Mesozoic diversity increase of bivalves, but it appears unlikely that this event alone explains the long-term evolutionary success of this important class of molluscs.

Symposium F – Poster

A remarkable wolf skull from the fissure fillings of Gargano, Southern Italy

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The Miocene fissure fillings of the Gargano peninsula (Southern Italy) are famous for their diverse and bizzarre island fauna, ranging from huge mice (*Microtia*), a giant hedgehog (*Deinogaleryx*) and a goat-like ruminant with five horns (*Hoplitomeryx*). However, apart from one otter species and some birds of prey, carnivores are lacking in this fauna. In a collection of the Gargano site, acquired by the Bavarian State Collection, a skull appeared, which did not fit to any of the animals known so far from this location. After comparisons with fossil and extant material, it turned out that this skull is most similar to the extant *Canis lupus*, although the Gargano specimen is slightly smaller.

There are no *Canis lupus* specimens known from the Miocene and the accompanying material of long bones of big mammals also suggests a younger age, probably after the island has been connected to the continent and after a fauna exchange; whereas the exact age of fissure fillings is always difficult to determine.

The preservation of the skull is relatively poor, as only parts of the posterior skull roof and of the left and right maxilla with few teeth and tooth fragments are preserved. To get a good reconstruction of the whole skull, the pieces were virtually put together and completed based on an extant grey wolf skull.

Symposium A – Vortrag/oral presentation

Intraspecific variations in the beak morphology and beak size of the African seed-cracker *Pyrenestes ostrinus*

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Intraspecific beak variation in *Pyrenestes ostrinus* is a text book example for disruptive selection and initiation of speciation. As the observed polymorphism is unique amongst birds and more remarkable than that observed in Darwin´s finches, the African seed-cracker has been part of many studies in terms of heritability of the bill traits and observation of its feeding behaviour.

There are three different morphs of *Pyrenestes ostrinus* and three types of sedge seeds (*Scleria*) the birds feed on, which differ significantly in hardness. During times of restricted food supply the large morphs specialise on the harder sedge seeds to decrease dietary overlap with smaller morphs and reduce intraspecific competition.

Although the first studies are nearly 40 years old, the mechanisms which drive and maintain the polymorphism are still not thoroughly understood and no biomechanical studies on the different beak morphs have been undertaken so far. The aim of the research presented here was to find out, whether the variation in beak shape between morphs affects the efficiency of cracking the different seeds.

To answer this question, physical fracture experiments using a guillotine testing device and specially designed tools, which simulate the different beak shapes and sizes, were undertaken. Work values for each seed type and bill type were recorded and resulting data analysed with Excel and PAST. No significant difference in cracking efficiency was observed between beak morphologies. There is no apparent biomechanical advantage for the large morphs to crack the large seeds in terms of shape, which means that probably only muscle size plays a role for an advantage in cracking efficiency. Another implication is that the main reason for maintaining the polymorphism is to avoid intraspecific competition.

Symposium D – Vortrag/oral presentation

Assessing the response of terrestrial palynofloras to the Cenomanian-Turonian Boundary Event

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The environmental perturbations associated with the onset of the Cenomanian-Turonian Boundary Event (CTBE) have received considerable attention during the last two decades. Much work has focused on the chemo- and biostratigraphy of this event as well as on the molecular composition of organic-rich black shales deposited during the OAE2, which represents the marine expression of the CTBE. In addition, various studies have addressed the response of the marine biosphere, including both, shoal-water and pelagic biota and ecosystems. Major perturbations in global biogeochemical cycling and climate have been postulated to be linked to the CTBE, including changes in atmospheric [CO_2] and sea-surface temperature. However, whereas information on the response of marine organisms to this event is well documented from many localities across the globe, data on the impact of the CTBE on continental floras is almost absent. To investigate the floral response to the CTBE and accompanying environmental perturbations, we studied the Cassis section of SE France with an integrated approach,

including bio- and chemostratigraphy, geochemical organic matter (OM) characterisation and terrestrial palynology. The chosen succession seems to be well suited for such an approach due to: (1) lithologies well suited for palynology, e.g. absence of black shales with abundant amorphous OM; (2) high sedimentation rates allowing for a comparatively high resolution; (3) considerable input of terrigenous OM from the nearby continent. Preliminary results show a positive shift in carbon isotopes, both of carbonate and bulk OM, which represents a typical feature of the CTBE and will allow correlation with existing records. TOC contents are relatively low and fluctuate between 0.2 and 0.8 %. RockEval pyrolysis shows low HI values (30–60 mg HC/gTOC) and variable OI values (20–140 mg CO_2/gTOC) pointing towards a significant terrestrial contribution to the bulk OM. This is supported by visual inspection of the OM, which shows high abundance of phytoclasts, spores and pollen. In terms of the spore-pollen diversity, the assemblage consists of numerous pteridophyte spores (15-30 %), gymnosperm (25-40 %) and angiosperm pollen (45-60 %), with the latter being mainly represented by different taxa of *Atlantopollis* spp. and *Complexiopollis* spp. of the Normapolles group. Other typical angiosperm pollen include *Phimopollenites* spp., *Striatopollenites* cf. *trochuensis*, *Multiporopollenites* spp., *Retitricolpites* spp. as well as various tricolpate and tricolporate forms. At the current stage, the diversity pattern does not show significant variations across the CTBE and most of the morphospecies can be found throughout the succession. This may indicate that floral assemblage were probably not as severely affected by the environmental perturbations as marine biota.

Freie Themen – Poster

Neue, seltene *Gerastos*-Funde (Trilobita, Proetida) aus dem Unter- und Mittel-Devon Süd-Marokkos

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Die Gattung *Gerastos* (Ordnung Proetida, Familie Proetidae) zeichnet sich durch einen stark gewölbten und granulierten Panzer aus, mit einer breiten, eiförmigen und ebenfalls stark gewölbten Glabella sowie einer aus 7-8 Thorax-Elementen bestehenden Rhachis. Die zeitliche Verbreitung dieser artenreichen Gattung (mehr als 40 Arten) ist auf das Unter- bis Mitteldevon (Pragium bis höchstes Mittel-Givetium) beschränkt. Entsprechende Faunen finden sich in Europa, Sibirien, Nord-Afrika sowie Nord-Amerika. Frühere Nachweise aus Marokko stammen aus dem Mittel-Givetium des Tafilalt (Feist & Orth 2000; Aboussalam 2003), Ober-Emsium und tiefen Givetium des Maider (Alberti 1970, Basse & Müller 2004, Feist & Orth 2000), Ober-Emsium des östlichen Dra-Tals (Chatterton et al. 2006) und dem Unter-Emsium und Eifelium/Givetium der Meseta (Alberti 1969).

Neue, seltene Funde wurden bei detaillierten Profilaufnahmen in drei Fundregionen gesammelt. Es handelt sich um Hassi Mouf-S südlich von Aouinet-Torkoz im westlichen Dra-Tal (Crinoid Marl Member, tiefes Eifelium), Bou Tserfine S von Assa im westlichen Dra-Tal (*Hollardops* Limestone Member, tiefes Ober-Emsium, und Crinoid Marl Member, tiefes Eifelium), sowie um Ouidane Chebbi im östlichsten Tafilalt (Taghanic Event-Interval, höchstes Mittel-Givetium, global die jüngsten Vertreter der Gattung), ergänzt durch ein gekauftes Exemplar des Tafilalt. Die untersuchten Formen lagen, bis auf zwei isolierte Cranidien, als komplette Dorsalpanzer vor.

Ein taxonomischer Vergleich mit anderen zeitgleichen *Gerastos*-Arten ist nur bedingt möglich. Die beiden Cranidien aus dem MD II – D/III-A von Ouidane Chebbi können auf Grund des ähnlichen Baus der Glabella sowie des Vordersaums und des Occipitalringes als *G.* sp. aff. *serus* bzw. *G.* cf. *serus* bestimmt werden, repräsentieren aber vermutlich ein eigenständiges Taxon (?Unterart). *G. serus* ist bisher nur aus dem Flinz-Kalk des Mittel-Givetiums bei Iserlohn im nördlichen Sauerland bekannt.

Die anderen Formen können keinen bekannten Arten zugeordnet werden. So zeigen sich zwar Gemeinsamkeiten mit Vertretern anderer Regionen, vor allem in Größe und Form der Glabella, Ausbildung des Cephalon-Vorderrandes und des Occipital-Rings, als auch im generellen Bau des Thorax und des Pygidiums, doch bestehen jeweils wesentliche Unterschiede. So ist die Granulierung der Glabella als auch anderer Teile des Panzers eher weitständig oder fehlt sogar. Insbesondere die Granulierung der Glabella ist, im Vergleich zu anderen Arten der Gattung, fein und in ihrer Größenverteilung homogener. Die Ocellenfelder, der neuen marokkanischen Vertreter bleiben im Vergleich zu den meisten anderen Arten kleiner. Die Pleural- und Rippenfurchen schneiden weniger tief ein und die Rhachis ist meist weniger breit (tr.). Der Rand-Saum des Pygidiums ist weniger gut entwickelt und die Wangenplattform wird deutlicher durch eine Kante von der Freiwange begrenzt.

Die früher beschriebenen marokkanischen *Gerastos*-Vertreter des Ober-Emsiums (*G. tuberculatus marocensis* und *G. akrechanus*) zeigen dagegen durchaus große Ocellenfelder und eine gröbere Granulierung der Glabella sowie deutlichere Pleural- als auch Rippenfurchen. Dies belegt Verbindungen mit europäischen Vertretern und zeigt, dass die Entwicklung der Gattung in S-Marokko, entsprechend anderer Trilobiten-Gruppen nicht isoliert verlief.

Abstract **Hengst et al.**, siehe S. 109

Symposium C – Vortrag/oral presentation

Quantitative paleobiology of a *Biradiolites mooretownensis* – bouquet (Maastrichtian, Guinea Corn Formation, Central Jamaica)

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In this presentation we want to present specific paleobiological parameters from the fossil record of a densely packed *Biradiolites mooretownensis* – bouquet (Bivalvia, Hippuritacea) from a Maastrichtian shallow marine carbonate platform. High-resolution analysis of the *in-situ* rudist association from the Guinea Corn Formation in Central Jamaica allowed detailed evaluation of growth, reproductive cycles, mortality, and population dynamics. For this study a total of 1.237 ascending tomograms with a vertical spacing of 0.1 mm have been produced and digitally measured for total area, number of specimens, packing density, recruitment, survival time, mortality, and accommodation space. The tomography was produced by the Heidelberg Grinding Tomography Lab using a G&M MPS 2R 300S precision grinding machine.

Constant coverage within the sample of about 60 %, a stable packing density of 3.2 individuals per cm^2 and a constant reproduction rate is present in the bouquet. This is interpreted as the optimal use of the area within a healthy rudist association. Within the section considered the packing density decreases by 0.2 individuals per mm. Time series analysis shows cyclic maxima of recruitment as well as dying every 12 mm which has been interpreted as annual reproductive cycles. The analysis of population dynamics for the species *B. mooretownensis* shows a decrease of at least 46.4 % of the settlers after the first 3 mm of growth. More than 93 % of the settlers do not exceed an adult age of 15 mm shell height or 1 year, respectively. Two mortality peaks at 4 mm and 10-15 mm shell height probably either represent important obstacles in the ontogenic development of the species or external influences. Furthermore, the survival time of a single settler is directly linked to the space that is available at the time of settlement. Settlers that finally reached adult ages benefited from an average of 9.3 % more free space at settlement than individuals that died at juvenile ages.

Symposium C – Poster

Ubiquity of sponges in Pennsylvanian (Moscovian and Kasimovian) platform deposits of the Cantabrian Mountains, Northern Spain

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During the earlier Pennsylvanian, an extended and more than 1500 m thick carbonate platform developed in the northeastern part of the Cantabrian Mountains (Ponga and Picos de Europa Units). It was progressively overwhelmed by carbonate-siliciclastic successions of the advancing Variscan orogen front, until marine sedimentation ceased in the latest Kasimovian/early Gzhelian. In contrary, in the southeastern part of the mountain range (Pisuerga-Carrión Unit) a multitude of synorogenic facies is recorded throughout the Pennsylvanian, including development of short-lived and spatially less extended carbonate successions. These carbonate rocks were interpreted to originate in mixed carbonate-siliciclastic delta settings and, in part, are redeposited as olistolites and in debrisflows in adjoining flysch basins. Sponges are virtually ubiquitous faunal elements in the studied Moscovian and Kasimovian carbonate successions. They occur in a wide range of environments and in part are important contributors to buildup formation. Most major groups are present.

Coralline demosponges include chaetetids and sphinctozoans. Chaetetids are widely distributed in Moscovian shallow platform settings. They form chaetetid level-bottom communities, monospecific chaetetid biostromes and the capping facies of algal (beresellid)-chaetetid buildups and syringoporid-chaetetid buildups. Variable growth types (digitate, lamellar, massive, oncolitic; in part with intergrown microbial laminae) appear to be mostly controlled by water-energy. However, preferential growth was in less agitated water. Starting in the late Moscovian, chaetetids are completely replaced by sphinctozoans. Both taxa do not co-occur. Sphinctozoans are surprisingly common and diverse and the Cantabrian Mountains might be considered as a hot spot for the late Palaeozoic evolution of the group. Delicate to slender taxa, in places forming dense meadows, inhabited low-energy, eutrophic muddy lagoons. In carbonate dominated lagoonal settings they intermingled with the stick-like growing dasycladacean *Anthracoporella*. On extended carbonate platforms predominantly large sphinctozoans dwelled in spicular sponge-echinoderm-sphinctozoan buildups below wave base.

Rare body fragments of demosponges, among those lithistids, and few hexactinellids are known, but remain without relevance. In contrary, sponge spicules are widespread. Most seem to belong to demosponges; unequivocal hexactinellid spicules are missing. Spicules occur below wave base in spicular sponge-echinoderm-sphinctozoan buildups and in syringoporid-chaetetid buildups. Common occurrences in algal buildups formed by *Anthracoporella* or *Archaeolithophyllum* and in sphinctozoan meadows stress the importance of spicular sponges in lagoonal inner shelf environments. Scattered spicules occur throughout bedded platform facies. Spicular remains of the boring sponge *Aka* from a bryozoan-crinoid-brachiopod buildup below wave, and preserved within the excavated gallery, merit special attention.

Symposium I – Vortrag/oral presentation

The role of microbial sealing of laminated sediment in exceptional preservation of Jurassic lake biota from Gansu (China)

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Preservational aspects of Middle Jurassic spinicaudatan branchiopods („conchostracans") from the Ordos inland basin, China, have been investigated at two localities about 370 km apart. The fine-grained siliciclastic sediments represent a deep permanent lake (1) and a shallow lake (2), respectively. The lake biota is dominated by the spinicaudatan genus *Euestheria* of the family Cyzicidae. In some horizons, they are associated with other invertebrates (darwinulid ostracods and freshwater gastropods) of low diversity. Fish remains occur scattered throughout both sections. At both localities the lacustrine deposits are intercalated between fluvial sediments. However, they differ markedly in thickness and sedimentological properties.

(1) The thickness of the lake sediments that had accumulated as part of the Wangjiashan Formation is 80.5 m, beginning with a palaeosol horizon that is overlain by mostly laminated, medium-grey clay and silt with few intercalations of fine-grained sandstone. The sedimentary matrix comprises a combination of clay minerals and silt-sized quartz grains. Thin-section analysis of fossiliferous strata reveals three depositional facies in the clay- to silty clay fraction. Facies A is non-layered, facies B is irregularly laminated due to the presence of microbial mats, and facies C is the biogenically reworked facies B, the reworking produced by (meiofaunal) bioturbation.

(2) The thickness of the lacustrine deposits of the Wangjiawan section is distinctly smaller (about 2.5 m). The sediments consist of finely bedded coarser siliciclastics. Thin-section analysis reveals rhythmic, sub-millimetric, graded laminae, each of them sealed at the top by a microbial mat. Spinicaudatan carapaces occur scattered within the silty matrix of each lamina. These rhythmites represent a distal lacustrine facies governed by seasonal changes in precipitation.

Spinicaudatan specimens were examined with Energy Dispersive X-ray Spectroscopy. The carapaces tested are composed of calcium phosphate with varying amounts of fluorine, sulphur, sodium, and iron. Aluminium and silica occur only in special cases. According to literature, silica replacement of parts of the carapace is connected with microbial mats. Here, partial silicification of the carapaces only occurs where more pervasive microbial alteration of the original layering took place, as documented within the finer-grained sediment of the Wangjiashan section (1). However, while the mineralogical mode of preservation differs depending on the development of microbial mats, morphological preservation of the carapaces is generally good in both lakes. Silica replacement appears to be a function of grain size. No sign of silica within the spinicaudatan carapaces of the Wangjiawan section (2) has been detected so far. In this case, the detailed preservation of the fossils is due to microbial sealing of each rhythmic lamina, which generated a closed system that may have resulted in reduced pH during stagnant conditions developing in the lake during dry seasons.

Symposium D – Poster

Palynologische Korrelation der Trias-Jura Grenze des Profils Kuhjoch (Tirol; GSSP) mit dem Norddeutschen Becken

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Zur Definition der Trias/Jura-(TJ-)Grenze wird im Norddeutschen Becken und südlichen Skandinavien im Allgemeinen das erste Auftreten des Ammoniten *Psiloceras planorbis* herangezogen. Mit der Festlegung des GSSP für die TJ-Grenze am Kuhjochprofil, Karwendel-Gebirge, Tirol, wurde der Ammonit *Psiloceras spelae tirolicum* zur weltweit gültigen Leitform. Zur Festlegung der Grenze wurden auch Palynomorphe verwendet. Die Entwicklung der Mikroflora in der höchsten Trias und im tiefsten Jura ist im Norddeutschen Becken lange bekannt. Für das Kuhjoch-Profil erarbeitete die palynologische Arbeitsgruppe der Universität Utrecht eine Gliederung. Im Rahmen der Exkursion der Stratigraphischen Jura-Subkommission 2009 erhielten wir die Möglichkeit der Beprobung des Typusprofils. Im Folgenden vergleichen wir diese 15 Proben des Kuhjochprofils sowie Literaturergebnisse mit norddeutschen und dänischen Profilen, im Wesentlichen Mariental 1, Eitzendorf 8 und Rødby 1 zum Zweck einer Korrelation der alpinen und norddeutschen Faziesbereiche.

Während im norddeutschen mittleren Rhätkeuper (*contorta*-Schichten) vorwiegend Koniferenpollen eine Rolle spielen, ändert sich im oberen Rhätkeuper (*Triletes*-Schichten) das Mikroflorenspektrum drastisch: Koniferen- und generell Baumpollen werden stark zurückgedrängt, Schachtelhalm- und Farnsporen gewinnen die Oberhand; besonders auffällig ist ein markantes Vorkommen der Farnspore *Polypodiisporites polymicroforatus*. Neben der deutlichen Veränderung innerhalb des Mikroflorenspektrums ist ein Farbumschlag der Exinen von hell nach dunkel auffällig, der nur in den *Triletes*-Schichten auftritt; in den tiefsten Juraproben ist die Exinenfärbung wieder so hell wie in den *contorta*-Schichten. Diese dunkle Exinenfärbung ist vermutlich auf häufigen „sauren Regen" zurückzuführen, der, verursacht durch den ca. 500.000 Jahre andauernden endtriassischen CAMP-Vulkanismus, über der Nordhemisphäre niederging und eine „natürliche Acetolyse" in Gang setzte. Alle untersuchten norddeutschen Profile sind an der TJ-Grenze diskordant, auch Teile der höheren *Triletes*-Schichten können betroffen sein. In der Bohrung Rødby 1 tritt ein Bereich mit zahlreichen *Ricciisporites tuberculatus*-Sporen über dem *Polypodiisporites*-Maximum auf. Darüber folgt die bisherige Jura-Basis mit häufigen *Pinuspollenites minimus* und dem marinen Faziesanzeiger *Leiofusa jurassica*.

Sowohl ein *Polypodiisporites*-Maximum, als auch die dunkle Exinenfärbung sind im höheren Rhät des Kuhjoch-Profils zu

beobachten. Die GSSP-Basis des Jura mit *Psiloceras spelae tirolicum* liegt im Bereich mit vielen *R. tuberculatus* und typischen Sporentaxa der *Triletes*-Schichten, ca. 4 m über dem *P. polymicroforatus*-Maximum. Dies bedeutet, dass die TJ-Grenze in Tirol im Norddeutschen Becken mit den höchsten *Triletes*-Schichten zu korrelieren ist und der Ammonit *Psiloceras spelae tirolicum* in den Alpen früher erscheint als *Psiloceras planorbis* im Norddeutschen Becken.

Symposium A – Vortrag/oral presentation

Profilaufnahme der Mörnsheim Formation (Ob. Jura, Tithonian) in Mühlheim (Oberbayern): Stand der Arbeiten

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Im Rahmen des Projekts Mühlheim erfolgt erstmals systematisch die feinstratigraphische Bearbeitung des Profils der Mörnsheim Formation (Ob. Jura, Tithonian) in einem neu eröffneten Steinbruch-Areal am Bremberg, südwestlich Mühlheim bei Mörnsheim im Gailachtal. Erstes Ziel ist die Erstellung eines Detailprofils (Maßstab 1:5) und eines Übersichtsprofils mit Charakterisierung und Benennung der einzelnen Schichtglieder. Die Arbeiten erfolgen seit April 2008 in einzelnen Abschnitten (Sektionen), jeweils mit horizontierter Profilentnahme (Vermessung, Erstellung von An- und Dünnschliffen) und anschließender großräumiger Profilgrabung zur detaillierten Aufnahme des Fossilgehalts. Bisher sind 12 Profilsektionen (A-L) im Steinbruch-Areal in Bearbeitung, entsprechend einer Gesamtmächtigkeit von etwa 10 Metern. Davon entfallen auf den hangenden Profilbereich im Besuchersteinbruch Mühlheim über 5 von insgesamt etwa 6 Metern hier aufgeschlossener Mörnsheim Formation, die weiteren Profilmeter auf den unteren bis mittleren Profilbereich im Steinbruch Krautworst.

Im Überblick zeigt die Mörnsheim Formation - im Kontrast zu den lithographischen Platten-kalken der unterlagernden Solhofen Formation - ein in Lithologie und Sedimentologie stark differenziertes Bild. Der untere bis mittlere Profilabschnitt ist überwiegend aufgebaut aus zähen, fein geschichteten, kreidig verwitternden Kieselplattenkalken und untergeordnet eingeschalteten kalkigen Partien, die bereichsweise durchgehend bioturbiert sind. Darin eingeschaltet ist eine Abfolge teilweise kompakt verkieselter Kalk-Bänke (Mächtigkeiten bis ca. 40 cm) mit zum umgebenden Gestein verschiedener Fossilführung (z.B. Ammonoidea, Bivalvia, Vertebrata) und Anreicherungs-Horizonten (z.B. „*Taramelliceras*-Bank“ = B-L-1, mit 3 „Ammoniten-Seifen“). Hangend der Bank B-H-5 („Krebs-Bank”) sind – auf engen Raum begrenzt - konzentriert Reptilienfunde zu verzeichnen (u.A. *Ctenochasma*, *Geosaurus*), womöglich zurückzuführen auf Zusammenschwemmung an einem durchgepausten Paläorelief des ehemaligen Meeresbodens. Im Hangenden Profilbereich der aufgeschlossenen Mörnsheim Formation (Besuchersteinbruch) zeigt sich lithologisch ein stärker differenziertes Bild mit kleinräumiger Wechsellagerung von fein geschichteten Kieselplattenkalken mit kalkigen Flinzen sowie vermehrt feinst geschichteten, tonigen Partien („Blätterflinzen“). Bioturbierte Abschnitte finden sich vorwiegend im liegenden Bereich. Horizonte mit Runzelmarken sowie mikroskopische Untersuchungen deuten auf das Vorhandensein von Algen- bzw. Cyanobakterienmatten. Eingeschaltete Bänke sind hier geringmächtiger (3 bis ca. 25 cm) und mit Ausnahme der kompakt verkieselten Bank BSb-L-1 überwiegend kalkig ausgebildet. Diese sind genetisch auf Suspensionsströme zurückzuführen (z.B. Top-Bank = BSb-H-2, mit mehreren, aufeinander folgenden Schüttungen) bzw. im Hangenden gradierter Einheiten (z.B. BSb-0) abgelagert. Generell ist oberen Profilabschnitt der Mörnsheim Formation eine Häufung turbiditischer Einschaltungen mit erosiven Basen, Gradierung und aufgearbeiteten Komponenten festzustellen, die sich in ihrem Fossilgehalt (u.A. Echinodermata, Foraminifera, insbesondere Porifera) deutlich von den umgebenden Plattenkalken unterscheiden. Als Liefergebiet ist ein nahe gelegener Schwamm-Riff-Komplex zu vermuten. In proximalen Bereichen der Turbidite muss auch mit jeweils nicht geringmächtiger Abtragung und daraus resultierenden Schichtlücken im Zentimeter bzw. Dezimeter-Bereich (Top-Bank) gerechnet werden.

Symposium G – Vortrag/oral presentation

Wo kommen die planktonischen Foraminiferen her?

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Molekurbiologische Untersuchungen von ribosomalen DNA-Sequenzen durch Genetiker haben ergeben, dass die heute lebenden planktonischen Foraminiferen eine unterschiedliche und voneinander unababhängige phylogenetische Abstammung von benthonischen Foraminiferen aufweisen, die zu unterschiedlichen Zeiten der Entwicklung der planktonischen Foraminiferen erfolgte. Konvergente Merkmale treten auch bei fossilen planktonischen Foraminiferen mehrfach auf. In der Kreide und im Tertiär kam es z. B. mehrfach zur Bildung von gekielten Formen, die nicht direkt miteinander verwandt sind. So stammen die morphologisch sehr ähnlichen „Globorotalien“ des Alt- und des Jungtertiärs von verschiedenen planktonischen Foraminiferen ab. Andrerseits zeichnen sich die planktonischen Foraminiferen durch verschiedene, gemeinsame morphologische Merkmale aus. Die Grundform der Kammern ist kugelig und zu einer mehr oder hohen Trochospirale angeordnet. Die ursprüngliche Mündung liegt umbilical und ist einfach gebaut. Die radiate Gehäusewand ist vorwiegend bilamellar. Die Porengröße ist unterschiedlich. Das Schweben im Wasser wird durch ein Ectoplasma ermöglicht, das einen vielfachen Durchmsser des Gehäuses besitzen kann. Die Oberfläche der Gehäuse der planktonischen Foraminiferen ist unterschiedlich ausgebildet und geht von glatt über gepustelt bis gestachelt. Auch bei diesem Merkmal treten häufig Konvergenzen auf. Planktonische Foraminiferen treten in pelagischen Sedimenten häufig gesteinsbildend auf.

Die ältesten Foraminiferen, die diese Kriterien erfüllen,

wurden im mittleren Jura gefunden. Es sind die Gattungen *Conoglobigerina* und *Globuligerina*. Besonders gut erhaltene, aragonitische Exemplare von *Globuligerina* stammen aus dem Bathonium des außeralpinen Jura von Polen und sie treten im alpinen Jura (Pieniny Klippen) von Polen in Kalzit umgewandelt gesteinsbildend auf. Für den mittleren Jura wird von verschiedenen Autoren ein aragonitischer Ozean angenommen und die Kompensationstiefe für Aragonit dürfte zu dieser Zeit tiefer gelegen haben als dies heute der Fall ist.

Als Vorläufer der mitteljurassischen planktonischen Foraminiferen werden von einigen Autoren die kleinwüchsigen, aragonitischen Oberhauserellidae angenommen, die erstmals in der oberen Trias der Alpen auftreten, die Trias/Jura-Grenze in einer phylogenetischen Reihe überschreiten und zumindest bis zum Toarcium reichen. Diese Familie und auch die aus ihnen hervorgegangenen Reinholdellina werden hauptsächlich in Sedimenten angetroffen, die unter zumeist schlechten Sauerstoffbedingungen abgelagert wurden. Die ungünstigen, dys- bis anoxischen Lebensbedingungen im unteren Toarcium sollen dazu geführt haben, dass die Oberhauserellidae eine planktonische zumindest zunächst mesoplanktonische Lebensweise annahmen. Gesteinsbildend s. str. kommen die häufig sehr gut erhaltenen Oberhauserellidae nicht vor und wie sieht es nun bei einem Vergleich der für planktonische Foraminiferen typischen Merkmale aus?

Symposium F – Vortrag/oral presentation

A short sketch on the studies of middle Miocene fossil rodent faunas in the Pannonian Basin

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Until only a few years ago the „pre-Pannonian" Middle Miocene formations were generally considered as non-perspective in regard to the vertebrate paleontological investigations in Hungary and Romania. However, intense field campaigns undertaken since 1996, have lead to the (re)discovery of rich continental mammalian samples in this „terra incognita".

Localities and faunas

Litke 1 & 2 (North Hungary, Nógrád County)

This lagoonal –freshwater locality is an intercyclic formation, bedded between Karpatian and Badenian marine sequences. Important mammal taxa (IMT): *Cricetodon meini*, *Alloptox gobiensis*. Correlation (CO): probably late MN5, early Badenian

Hasznos (North Hungary, Nógrád County, Hasznos is a part of the town Pásztó)

White diatomit (part of the Szurdokpüspöki Formation) which is bedded onto the Hasznos Andesite Formation with discordance. IMT: *Cricetodon hungaricus*, *Democricetodon hasznosensis*. CO: MN6, early Badenian

Sámsonháza 1-4 (North Hungary, Nógrád County, Southern slope of Buda Hill)

The SW slope of the Buda Hill is the type section of the early Badenian Sámsonháza Formation, which consists of different calcareous sediments containing rich marine faunas. MT: *Cricetodon* cf. *hungaricus, Miodyromys aegercii.* CO: Chronological position: MN6, „middle" Badenian.

Mátraszőlős 1 & 2(North Hungary, Nógrád County)

The sediment complex is clasified as a part of the Sajóvölgy Formation. IMT: *Cricetodon* sp., *Eomyops oppligeri, Muscardinus* aff. *Sansaniensis*. CO: MN 7/8, late Badenian

Subpiatră 2/1-3 (Romania, Bihor County)

IMT: Myoglis meini, Muscardinus sansaniensis, Muscardinus aff. *sansaniensis.* CO: Su 2/1: MN6, Su 2/2 and 2/3: MN7/8.

Tăşad 1-2. (Romania, Bihor County)

The fossiliferous green marl is overlied by Sarmatian limestone. IMT: *Muscardinus* aff. *sansaniensis, Cricetodon* sp. CO: MN 7/8, early Sarmatian, Volhynian substage.

Comăneşti 1. (Romania, Arad County)

The microvertebrate derive from from lenses of tufaceous sand. IMT: *Hispanomys.*The layer CO: probably MN 7/8, lower Sarmatian, Volhynian substage.

Vârciorog (Romania, Bihor County)

The freshwater series is overlaid by Sarmatian limestone. IMT (unpublished):

Cricetodon sp.. CO: probably MN 7/8, Sarmatian.

The faunas of the Felsőtárkány Basin (North Hungary, Heves County)

Lacustrine –continental series above ignimbrite (13.7 +- 0.8 Ma) and Brackish Sarmatian sandstones. IMT (7 faunas): Pliopithecoid, *Cricetodon klariankae*, *Collimys dobosi, Microtocricetus molassicus.* CO: MN 7/8 to 9, Sarmatian to ? Pannonian.

Tauţ (Romania, Arad CountyTufaceous green clay. IMT: *Democricetodon zarandicus* CO: MN 7/8?, late Sarmatian.

Conclusions

The Hungarian and Romanian deposits demonstrate a huge potential for research in small mammal paleontology. Furthermore, the continental-marine superposition allows the possibility of bilateral control of the biostratigraphical proposals. This promises a better understanding of the faunal migrations in Eurasia.

Symposium F – Poster

Dinosaur tracksites in the Bückeberg Formation (Berriasian, Early Cretaceous) of Lower Saxony, northern Germany

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The late Berriasian Obernkirchen Member of the Bückeberg Formation yields abundant and diverse dinosaur tracks. These are concentrated in the Obernkirchen Sandstone and its lateral equivalents, deposited in a freshwater, alluvial to deltaic and sandy barrier environment in the southern Lower Saxony Basin, west to south of Hanover. During the 1850s to 1870s, „structures", often found during quarrying, were already recognized as tracks formed by animals or, more precisely, „giant

birds". The subsequent research history can be subdivided to several, partly discontinuous, epochs:

c. 1879–1881: Pioneering epoch, discovery and identification of iguanodontian dinosaurs as trackmakers

c. 1900–1930: Intensive collecting and sporadic research, identification of various types of trackmakers, including ankylosaurs and theropods

c. 1950–1979: Sporadic theoretical discussion of results from previous research, only one new find recovered and described

1979–1998: Discovery of *in-situ* sauropod tracks, first concept for conservation and touristic exploitation developed during the 1980s

Since 2004: Discovery of new track horizons at various locations with abundant trackway assemblages, excavation campaigns and concept development for partial conservation

Numerous individual tracksites have been reported, but the decrease of quarrying operations since the early 20th century led to a loss of several outcrops. The identification of single tracksites is further complicated by imprecise locality descriptions and careless application of locality names. A recent survey resulted in the identification of at least 13 tracksites, of which 5 are still accessible:

Rehburg Mts. (4 localities) – 2 localities still accessible, 1 with completed and active conservation and public access concept and protected under conservational law, 1 with active research and excavation program

Bückeburg - Harrl hill (2 localities) – 2 localities still accessible, protected under conservational law and with active research program

Bückeberg - Obernkirchen (5 localities) – 1 locality still accessible, with active research and excavation program and conservation and public access concept under development

Osterwald mountains (2 localities) – Both largely inaccessible, but current status under study

The diverse suite of trackmakers include several morphotypes of theropods and ornithopods (various ontogenetic stages), other small and biped ornithischians, rare ankylosaurs and sauropods.

Although limited to a comparatively narrow stratigraphic interval, the strict isochrony of the tracksites cannot be proven due to the lack of very high resolution stratigraphic correlation. Therefore, the track occurrence cannot be currently addressed as a megatracksite *s. str*.

Die Chiemsee Furchensteine: Wie aus Bioerosion eine Katastrophe wird

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Auffällige, von labyrinthisch gewundenen Kanälen durchzogene, sogenannte „Furchensteine" findet man sehr häufig an den Ufern des Chiemsees. Dort werden sie ihres Aussehens wegen auch Hirnsteine genannt. Die biogenen Prozesse, die zur Entstehung dieser markanten Muster führen, sind schon seit Langem bekannt und in der wissenschaftlichen Literatur ausführlich beschrieben (z.B. Golubic 1962; Schneider & Le Campion-Alsumard 1999). Die Furchenbildung findet unter einer cyanobakteriell gebildeten, karbonatischen Kruste statt. Bohrende Endolithen und weidende Organismen bilden dort durch biologische Korrosion und Ablation die Furchen auf karbonatischem Substrat. Furchensteine sind europaweit verbreitet und in zahlreichen karbonatreichen voralpinen Seen dokumentiert. Allerdings gibt es keine wissenschaftliche Erwähnung der Vorkommen im Chiemsee. Dies führte in jüngster Zeit zu einer kuriosen Verwechslung: Eine Gruppe von Wissenschaftlern und Laien, die sich „Chiemgau Impact Research Team" nennt, postulierte unter erheblichem Presseecho einen holozänen Kometeneinschlag im Chiemgau. Sie deuten die Furchensteine fälschlich als Ejekta und deren Furchen als Regmaglypten (Ernstson, 2008). Nach dem Einschlag eines Himmelskörpers seien große Mengen an Gestein emporgeschleudert worden. Diese hätten die glutheiße Explosionswolke durchflogen und dort durch Schmelzprozesse eine Furchung, sogenannnte Regmaglypten, erhalten. Wir nehmen dies als Anlass, die Furchensteine des Chiemsees hier zu präsentieren. Wir zeigen ihren eindeutig biogenen Ursprung und stellen die bekannten Bildungsprozesse - Biomineralisation und Bioerosion - noch einmal vor.

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Symposium D – Vortrag/oral presentation

Disperse Kutikulen aus dem Viseum von Glösa bei Chemnitz

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Kutikulen sind ein wichtiger Bestandteil der Taxonomie fossiler Pflanzen. Sie dienen nicht nur der Beschreibung und Klassifizierung von Abdruckresten, sondern können auch Aufschluss über ökologische Aspekte liefern.

Im Mississippium sind Kutikulen aufgrund von thermischer Überprägung des Materials äußerst selten und wurden daher kaum beschrieben. Neue Funde aus dem Viseum von Glösa bei Chemnitz weisen eine nur geringe thermische Überprägung auf. Die Mazeration mehrerer Bulkproben lieferte eine Vielzahl verschiedener disperser Pflanzenkutikulen. Eine genaue taxonomische Zuordnung ist aufgrund spärlicher Vergleichsdaten jedoch schwierig.

Die Spaltöffnungen einiger Fragmente ähneln denen der Lycopsiden *Selaginella* und *Lycopodium* und erstaunlicherweise auch denen der Gattung *Swillingtonia*. Letztere wurde als die älteste (Duckmantium/Westfalium B) bekannte Konifere beschrieben. Aufgrund der für Koniferen untypischen Spaltöffnungen muss *Swillingtonia* jedoch vermutlich zur Gruppe der Lycopsiden gestellt werden, ebenso wie die Fragmente aus Glösa.

Das Material beinhaltet darüber hinaus diverse Sporen, Arthropoden-Kutikulen und eine Pflanzenkutikula mit Abdrücken dreier Pilzthalli. Letztere sind taxonomisch nicht zuordenbar, lassen jedoch Rückschlüsse auf die Interaktion zwischen Pilz und Pflanze zu.

Die Kutikulen aus Glösa liefern somit neue und wichtige Erkenntnisse über die Pflanzen des Mississippiums und ihre Ökologie.

Symposium B – Vortrag/oral presentation

Evolutionary and ecological implications of trematode parasitism of modern and fossil northern Adriatic bivalves

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Antagonistic relationships between organisms (including predation, parasitism, and competition) have been viewed as key processes driving long-term trends in the history of life. However, it has been argued that processes occurring at ecological time scales (10^{-1} -10^{3} years) cannot produce evolutionary trends sustained over geologic time scales (10^{5} – 10^{8} years). Many marine invertebrates bear the scars of these struggles for life in the form of predatory drill holes and repair scars as well as traces produced by parasites. Previous work demonstrated a strong correlation between predation intensity and genus-level diversity through the Phanerozoic. Though debate continues, it seems that interactions between predator and prey do matter over evolutionary time scales, but what about parasites? Parasites outnumber predators in abundance and diversity, and would seemingly play important roles in the evolutionary theatre as well. Trematodes are parasitic worms, which infest bivalve molluscs, consume their nutrient-rich gonads, and leave distinctive oval-shaped pits and blisters on the interior of the shell.

This project is the first in a series to better understand the distribution of trematode parasitism in modern and ancient environments. We surveyed 11.841 bivalves from the northern Adriatic coast of Italy and Pleistocene – Holocene Po River Plain deposits (5.897 modern and 5.944 fossil specimens) for traces of trematode parasites. Two-hundred two fossil individuals and three modern individuals displayed trematode-induced pits and blisters. Though only 1.7% of individuals were infested by trematodes, parasitism was not evenly distributed taxonomically. In particular, some fossil samples of the commercially-important species *Chamalea gallina* displayed infestation rates as high as 33% and 45%; suggesting that trematodes were an important agent of natural selection. Given the life cycle of trematodes, which requires a vertebrate predator (the definitive host, often birds and mammals) to consume the bivalve (the intermediate host), one would hypothesize that trematode infestation would be more common in shallower environments. There is no significant difference in depth of deposition between stratigraphic intervals with trematode traces and those intervals without (Mann-Whitney U: 105; *p*: 0.39). One caveat is that the samples are restricted to shoreface settings and future work should include surveying lagoonal and transitional platform samples. In Holocene samples, individuals preserved in transgressive systems tracts (TST) were significantly more likely (Fisher's Exact *p*:1.21E-36) to be parasitized (7.9%) than those in highstand systems tracts (HST; 0.2%). High sedimentation rates and freshwater plumes associated with deltas during HST may be less suitable environments for trematodes than during TST when sediment deposition is focused in estuaries. This would explain the decrease in parasitism frequency from the Holocene to the modern given that the recent samples were collected less than 50km from the Po River delta. The overall low frequency of parasitism is in agreement with the suggestion that antagonistic biotic interactions are not as intense in the northern Adriatic as in other shallow marine settings.

Symposium I – Vortrag/oral presentation

An evolutionary fast track to bio-calcification

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Biocalcification is a hallmark of coral reef evolution and development, and is a process currently thought to be compromised due to changing ocean conditions. An understanding of the metazoan origins of the ability to biocalcify would be significant because the appearance of this trait within diverse lineages coincides with the appearance of many disparate body plans in the fossil record. Furthermore, this understanding would allow us to asses the potential of organisms to adapt to forecasted ocean conditions. Here we show that *Astrosclera willeyana*, a living representative of the now largely extinct stromatoporid sponges (a polyphyletic grade of poriferan bauplan), has apparently bypassed the requirement to evolve mineral-regulating matrix proteins by using the degraded remains of bacteria to seed $CaCO_3$ crystal growth. In combination with previous work where we characterised the action of an alpha carbonic anhydrase and its role in spherulite formation (Jackson et al. 2007, Science 316), we are now developing a model of skeleton formation in this early branching metazoan. This model suggests that it was a combination of highly conserved genes inherited from the last common ancestor of the Metazoa, and lineage specific events (i.e. bacterial seeding of spherulite formation) that supported the evolution of skeleton formation in this so called 'living fossil'. This biocalcification strategy has enabled *Astrosclera willeyana* to withstand about 210 million years of changing ocean conditions. i.e. since the Triassic.

Symposium D – Vortrag/oral presentation

Mikrofloren aus dem Obervisé der Nordsee und Sachsens – Hinweise auf paläobotanische Unterschiede zwischen Laurussia und Peri-Gondwana

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Im äußersten SE des Saxothuringikums am Nordrand der Böhmischen Masse wurden in der Umgebung von Chemnitz palynologische Untersuchungen in den Delta- bis Floodplain-Abfolgen der unterkarbonischen Frankenberg Formation durchgeführt. Die eingeschalteten dünnbankigen Silt- und Tonsteinlagen enthalten eine umfangreiche, mäßig bis gut erhaltene Mikroflora, die palynostratigraphisch und bezüglich der Zusammensetzung der Sporen-Assoziationen und deren paläobotanischer Interpretation analysiert wurde. Die Proben aus Sachsen wurden verglichen mit altersäquivalenten Proben aus vergleichbaren Ablagerungs-Systemen aus dem Bereich der Nordsee (NW-Deutschland, GB). Die Proben aus Sachsen stammen vom Schelf Peri-Gondwanas, während die Proben aus der Nordsee vom Schelf Laurussias stammen, so dass Vergleiche der Mikroflora Hinweise auf die paläobotanische Entwicklung im oberen Visé nördlich und südlich des rhenoherzynischen Beckens ergeben.

Die Palynofazies ist sehr ähnlich in beiden Gebieten, aber die Mikroflora in den Proben aus Sachsen zeigt eine geringere Diversität. Die qualitative Analyse der Sporen-Assoziationen zeigt eine deutliche Übereinstimmung zwischen den beiden Gebieten. Aufgrund der geringeren Diversität fehlen in Sachsen allerdings bis zu 30 % der Genera, die in den Assoziationen aus der Nordsee typisch sind. Gravierende Unterschiede zeigt die quantitative Analyse der Mikrofloren. Die Sporen-Assoziationen aus Sachsen zeigen einen deutlich höheren Anteil an runden und dreieckigen Sporenformen und wesentlich weniger rundlich-trianguläre Übergangsformen als die Assoziationen aus der Nordsee. Besonders stark ornamentierte und cingulate Formen, typisch in den Nordsee-Proben, sind in Sachsen sehr selten oder fehlen. Dasselbe gilt für Genera wie *Tripartites*, *Triquitrites*, *Lycospora* und *Cingulizonates*, die im oberen Visé der Nordsee sehr häufig auftreten, in Sachsen jedoch extrem selten sind oder fehlen.

Diese deutlichen Unterschiede in den Mikrofloren, deuten auf signifikante Unterschiede in der Landvegetation zwischen Laurussia und Peri-Gondwana im oberen Visé hin. Die Mikrofloren aus dem Nordsee-Bereich werden stark dominiert von Sporen, die mit Lycopsiden assoziiert sind. Daraus lässt sich ein hoher Anteil an Waldmoor in der Landvegetation entlang der Südküste Laurussias ableiten. Im Gegensatz dazu zeigen die Mikrofloren aus Sachsen einen hohen Anteil Farn-dominierter, Wald-loser Sumpflandschaften an der Nordküste Peri-Gondwanas (Nordrand der Böhmischen Masse) an. Da die Proben aus vergleichbaren Paläoenvironments stammen, sind diese Unterschiede nicht auf taphonomische Effekte, sondern auf primär unterschiedliche Vegetationstypen nördlich und südlich des rhenoherzynischen Beckens zurückzuführen. Um einen besseren Einblick in die Verteilung und Entwicklung der Landvegetation nördlich und südlich des rhenoherzynischen Beckens im oberen Paläozoikum zu bekommen, ist die Ausdehnung der Untersuchungen an der Südküste Laurussias nach Westen (NE-Irland) und entlang Peri-Gondwana nach Osten (Südpolen) geplant.

Eine kleine Schildkröte (Reptilia: Testudines) aus dem Oberen Jura Niedersachsens (Norddeutschland) und ihre Referenz für aquatische Anpassung und Ontogenie

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Der Langenberg-Steinbruch in der Nähe der Stadt Oker in Niedersachsen, Norddeutschland, ist bekannt für seine reiche oberjurassische Wirbeltierfauna, zu der Theropoden, Sauropoden, Pterosauria, aber vor allem auch Krokodile und Schildkröten zählen.

Schildkrötenfunde aus Oker sind relativ häufig, bestehen aber meist aus undiagnostischem isolierten Material. Die außergewöhnlich vollständig erhaltene Schildkröte aus den Schichten des mittleren Kimmeridge kann durch ihre gute Erhaltung weitere Schlüsse auf den Lebensraum der Schildkröten aus Langenberg geben. Hier ist vor allem interessant zu prüfen, in wieweit oberjurassische Schildkröten aus randmarinen Sedimenten an eine aquatische Lebensweise angepasst sind, um marine und Süßwasser-Habitate zu unterscheiden.

Der Rückenpanzer des Individuums ist vollständig sichtbar. Die rechte Vorderextremität sowie der Schädel sind teilweise erhalten. Der laterale Teil des Hyo- und des Hypoplastrons ist durch die lateralen Fontanellen des Carapaxes, gebildet durch die freistehenden Rippenenden der Costalia, zum Teil ebenfalls sichtbar. Folgende Merkmale deuten auf ein frühes ontogenetisches Stadium des Tieres hin und erschweren somit den Vergleich mit stratigrafisch ähnlich alten Stücken sowie eine weitere taxonomische Einordnung. Zu diesen Merkmalen zählt vor allem die Erhaltung des Schädels, der entlang der Suturen in seine einzelnen Elemente zerfallen ist. Die freistehenden Rippenenden im gesamten Carapax implizieren ebenfalls ein mögliches juveniles Stadium des Tieres. Solcherart gebildete Fontanellen gibt es allerdings auch bei adulten Schildkröten, wie zum Beispiel den oberjurassischen Eurysterniden, wo sie als Indiz für eine marine Anpassung gedeutet werden. Der sichtbare laterale Teil des Plastron des Okerstücks weist ebenfalls große Fontanellen auf. Diese könnten sich im Laufe der Ontogenese schließen oder aber wiederum wie bei den Eurysterniden offen bleiben. Letzteres würde auf eine Reduktion des Plastrons hin zu mariner Anpassung deuten. Das am Okerstück gemessene Verhältnis Armlänge/Handlänge ist in jedem Fall typisch für eine aquatische Schildkröte.

Die mit nur 7 cm sehr geringe Gesamtgröße des Individuums sowie die Erhaltung des Schädels ist eindeutig mit einem juvenilen Stadium vereinbar.

Aufgrund der Gesamtheit der Merkmale handelt es sich bei dem Okerstück eindeutig um eine juvenile Schildkröte mit einer Anpassung an einen aquatischen Lebensraum. Diese Ergebnisse ermöglichen vieleicht eine genauere taxonomische Einordnung im Vergleich mit stratigrafisch ähnlich alten Funden.

Biological response to short-termed ocean acidification events in the past: biodiversity and evolution patterns of marine primary producers (calcareous nannofossils) during the PETM (Demerara Rise)

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The composition of calcareous nannofossils has been investigated from an equatorial section (Demerara Rise; ODP Site 1258C; 191.70–196.80 mbsf) which covers the Paleocene–Eocene boundary interval or Paleocene–Eocene Thermal Maximum (PETM). The PETM was marked by a substantial input of methane into the oceans, related to a general warming trend, which led to ocean acidification. Perturbations of the carbon system caused significant changes in the composition of marine biota.

The PETM interval of Site 1258C, defined by the onset and the termination of the $\delta^{13}C$ excursion is 1.24 m thick (195.77–194.53 mbsf). The lowermost 67 cm-thick interval (195.77–195.10 mbsf) with a carbonate content lower than 20% includes a distinctive basal clay layer of approximately 40 cm thickness. Calcareous nannofossils show distinctive changes in the assemblage composition as follows.

A slight increase of *Coccolithus subpertusus* precedes the onset of the PETM and might indicate warm water conditions in pre-PETM time, which perhaps triggered the PETM. The onset of the PETM is then marked by a drop in the diversity of calcareous nannofossils from 27 species (195.79 mbsf) to 0 (195.77 mbsf). After the first barren sample (195.77 mbsf), the characteristic *Discoaster araneus* appears with low abundances (first occurrence (FO) at 195.70 mbsf). The genus *Fasciculithus* re-occurs after the first barren sample in low numbers. In the basal clay layer above the barren sample diversity fluctuates between 5 and 20 species (195.75–195.47 mbsf), before it recovers to the pre-PETM level in samples above 195.45 mbsf. At the top of the 40 cm clay layer *Rhomboaster cuspis* (FO 195.45 mbsf) occurs, which is seen as a proxy for increased salinity. This event is postdated by common occurrences of *Coccolithus bownii,* often malformed, and *Discoaster araneus* at 195.40 mbsf. This goes along with the recovery of the genus *Toweius* which is indicative of mesotrophic conditions. *Tribrachiatus bramlettei* (FO 195.38 mbsf), which is also seen as a proxy for increased salinity appears in low abundances. *Campylosphaera*, *Neochiastozygus* and calcareous dinoflagellate cysts show rising abundances, indicating mesotrophic to eutrophic conditions in the same sample.

Symposium J – Vortrag/oral presentation

The origin and early history of Lepidosauromorpha (Diapsida)

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Today Lepidosauria (lizards, snakes, tuatara) are a globally widespread group comprising over 7000 species. Of these, almost all are members of Squamata with only a single genus representing the sister group Rhynchocephalia: *Sphenodon* (the tuatara of New Zealand). By definition both clades originated at the same time, therefore this current difference in diversity is conspicuous. The earliest known members of both groups are Late Triassic (Carnian) in age: *Tikiguana* (India) and *Brachyrhinodon* (UK) / cf. *Diphydontosaurus* (USA) respectively). However, the derived nature of the existing material suggests that lepidosaur origins lie in the Early or Middle Triassic and a new fossil jaw from Germany supports this inference. Non-lepidosaur lepidosauromorphs recently described from the Early Triassic of Poland are also consistent with this. *Pamelina* extends the fossil record of the enigmatic long-ribbed Kuehneosauridae from the Late Triassic whereas the small terrestrial *Sophineta* lacks only a few key lepidosaur characters. In conjunction with the Middle-Late Jurassic *Marmoretta*, these animals are important for evaluating character polarity and character acquisition within early Lepidosauria *sensu stricto*.

The Late Triassic *Tikiguana* and the Early Jurassic *Bharatagama*, both from India, are currently the only squamates known prior to the Middle Jurassic. By contrast the rhynchocephalian record from the same period is global and includes more than 15 taxa occupying a range of niches. Records of plesiomorphic „basal taxa" (e.g. *Gephyrosaurus*) from the Late Triassic of Europe, Late Triassic of North America (e.g. *Whittakersaurus*) and Early Jurassic of India (*Rebbanasaurus*) suggest that the earliest rhynchocephalians radiated prior to continental break up. A similar hypothesis for sphenodontines is supported by material from the Jurassic of Mexico (e.g. *Cynosphenodon*), UK and India, and for clevosaurs by Late Triassic/Early Jurassic specimens from North and South America, southern Africa, and northern Europe. Articulated, but poorly preserved, clevosaur skulls from the Early Jurassic of China remain the only record of Rhynchocephalia from Eastern Asia. The long-bodied aquatic pleurosaurs (Jurassic of France and Germany), *Pelecymala*, *Sigmala* (both Late Triassic, UK) and enigmatic *Palaeollanosaurus* (Late Triassic, USA) hint at further unrecorded diversity. Therefore, despite the persistently patchy fossil record of small vertebrates, current data suggests that rhynchocephalians may have been of equal or greater diversity to squamates during the first half of lepidosaur evolution. Understanding the palaeoecological and palaeonvironmental context of this diversity may provide answers as to why rhynchocephalians appear to have declined with respect to squamates towards the end of the Mesozoic.

Symposium B – Vortrag/oral presentation

Gastropod recovery after Permian-Triassic mass extinction

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Gastropoda is one of the most diverse invertebrate groups nowadays and it was so also in the geological past. High diversity was probably one of the reasons why gastropods (as well as bivalves) were less affected by the end-Permian mass extinction than other groups. Thanks to their continuous record through P-T boundary gastropods play an important role in the paleodiversity analyses of the P-T crisis. Popular phrases like „Lazarus Taxon", „Elvis Taxon", „Dead Clade Walking", and „Waldo Taxon" were first coined for the gastropods. It is also known that profound shifts in the clade Gastropoda have occurred during the aftermath of the P-T extinction. Early Triassic gastropods usually occur as mass shell aggregations of very low taxonomic diversity. These occurrences are known as microgastropod biofacies and distributed worldwide. Although this facies is known from several localities in Paleotethys, Neotethys and Panthalassa, only few faunas were investigated so far. Commonly, the taxonomy of these microgastropods is not treated because workers lack taxonomic expertise or preservation is too poor. Generally, investigations of this crucial early period of the gastropod recovery after P-T extinction are seriously hindered by poor preservation, especially in the post-extinction interval (Griesbachian). Nevertheless several new faunas have been recently described or are under description.

Rich and relatively well preserved assemblage of Griesbachian (Early Induan, earliest Triassic) gastropod fauna composed of about eleven species is known from single locality in Oman. Sections in southern China provided several Early Triassic gastropods faunas, although their descriptions are dispersed in more general monographs on mollusk fossils in Chinese Permian and Triassic. Single gastropod fauna (consisting of four species) has been recently described from Late Griesbachian of Shanggan (Guangxi Province) and another Griesbachian fauna from the same area is under description. Probably the best preserved Griesbachian-Dienerian fauna has been described in 2009 from Abrek (Primorye, Far East Russia) where gastropods are represented by nine species (including two species of bellerophontids) occurring in severals layers of the section. Majority of the information on Dienerian (Late Induan, Early Triassic) gastropods comes from Werfen Formation in the Alps and from Smithian (Early Olenekian, Early Triassic) gastropods from the Sinbad Limestone in Moenkopi Formation of Utah, USA. Even less is known for Spathian (Late Olenekian).

The period from Griesbachian to Spathian has been interpreted as survival interval characterized by blooms of disaster and opportunistic taxa. This exceptionally long time of faunistic recovery after end-Permian mass extinction (estimated as 4-9 million years) was interpreted as caused by harsh environmental perturbations during Early Triassic evidenced

by several excursions in isotopic composition. However, the detailed studies of Triassic bellerophontids and ongoing studies of other groups of gastropods suggest that gastropods strated to recover much earlier having in Smithian a local abundance peak followed by drop in diversity in the Spathian. It seems that end-Smithian extinction event (already known from conodonts and ammonoids) has been responsible for the drop of gastropod diversity associated with complete extinction of bellerophontids. Following period starting with Anisian (Middle Triassic) is considered to be recovery interval. Rich Anisian gastropod faunas are known mostly from European Muschelkalk and China and a new, rich Ladinian gastropod fauna from Croatia is now under description. It is widely accepted that the peak of the gastropod diversity in Triassic times occurred in Carnian exemplified by well preserved gastropod faunas The Cassian Formation in South Tyrol (northern Italy). With more than 500 nominate species the Cassian gastropod fauna represents the most diversified fauna from early Mesozoic times.

Symposium I – Vortrag/oral presentation

Dentine in details: tooth microstructures in extinct ground sloth and glyptodonts (Mammalia, Folivora and Cingulata)

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Members of the superorder Xenarthra (comprising sloths, armadillos, anteaters and their extinct relatives) are different from other mammals in many ways and one of the most striking features is the total loss of tooth enamel in all members but the earliest armadillos. However, sloths (and armadillo) teeth show structured wear facets, even with sharp cutting blades, which are in all other mammals formed by tooth enamel. How is that possible?

Xenarthrans have developed ever-growing teeth with a layered composition of different dentine types and with cementum. The tooth tissues have been treated with a new preparation technique which combines three different processes: etching, staining and fixating. SEM analysis reveals microstructural details which could not been achieved before. In comparison to other mammals, especially the orthodentine microstructural build-up is unique and represents a previously not described dentine tissue in mammals. The microstructural differences seem to have a major effect on the biomechanical qualities and/or on the biochemical regulating transport system of that tissue and might be the key to its extraordinary properties in sloths.

Symposium F – Poster

Giants and their little secrets: Dentine microstructures in mylodontid ground sloths (Mammalia, Folivora)

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Giant ground sloth teeth lack tooth enamel as this is typical for all toothed xenarthrans. Xenarthrans have developed continuously growing teeth with a composition of different dentine types and of cementum. They actively chew their food and therefore need tooth relief. Resistant rims are generally formed by orthodentine. A broad scanning electron microscopic study of microstructures in xenarthran teeth revealed that species of *Scelidotherium*, *Lestodon*, *Glossotherium*, and *Mylodon* have an unusual, washboard-like structure in the outer portion of their orthodentine. Raised parts are radially orientated and perpendicular to the outer margin of the tooth. Microstructurally, the washboard-like structure consists of bundles of several individual dentinal tubules (ca. 5-15 per bundle). This is remarkable because dentinal tubules usually are subparallel to each other. In scelidotheriid and mylodontid sloths instead, tubules form bundles which coverge towards the tooth's centre and which are between 300 to 700 µm in length. The bundles therefore look like ice cream cones and are somewhat offset against each other. This structure, which is considered to be a derived character, was found in specimens which are late Pliocene and younger in age. It is an interesting fact that both *Octodontotherium* as well as *Nematherium* as basal mylodontids lack the washboard-like structure. This leads to the hypothesis that this structure has been developed independently in scelidotherine sloth and in mylodontine sloths. The structure might serve as a grinding reinforcement to enhance food processing in the oral cavity. Remarkable is that the washboard-like structure occurs both in wide- and narrow-muzzled ground sloths which are thought to have had different feeding behaviors. The structure can be compared to functionally similar structures known from rhinocerotid enamel, which are there caused by vertically oriented Hunter-Schreger bands.

Symposium I – Keynote

Microbial formation of iron minerals in modern and ancient environments

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Iron is present in almost all terrestrial and aquatic systems with ferrous iron [Fe(II)] and ferric iron [Fe(III)] being the two most important redox states. There is evidence that since more than 3 billion years microbes are able to harvest energy from oxidation of dissolved Fe(II) precipitating Fe(III) mineral phases or by reduction of Fe(III) via oxidation of organic

matter coupled to electron transfer to poorly soluble Fe(III) oxyhydroxides. Iron redox cycling at neutral pH is closely related to mineral precipitation, dissolution and transformation and is therefore inherently linked to the environmental behaviour of nutrients, trace metals and pollutants. This presentation will introduce these different iron biogeochemical processes and will give examples for the importance of iron mineral transformation in modern and ancient environments.

Symposium C – Poster

Microbial diversity in the coralline sponge *Vaceletia crypta*

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The coralline sponges, also called sclerosponges, are unique members of Phylum Porifera because they build a solid (‚hypercalcified') calcareous skeleton, similar in appearance to some reef building corals. During long periods of the Earth's history coralline sponges were dominant reef-building organisms and are regarded as ‚relict taxa' or ‚living fossils'. *Vaceletia* is the only recent member of so-called 'sphinctozoan-type' sponges, which contributed to reef-building in the Palaeozoic and Mesozoic. Thought to be extinct, *Vaceletia crypta* was rediscovered in the 1970's. The coralline sponges, comparable as recent sponges harbour rich and various symbiotic microorganisms in their tissues, although their microbial diversity was never investigated. Applications of culture-independent molecular techniques have greatly improved our knowledge of microbial communities in sponges, however the clear picture remains still afar. Here we provide the first insight into microbial diversity in the coralline sponge *Vaceletia* obtained using molecular methods. Bacterial 16S rDNA clone library of 400 clones was constructed from specimen of *Vaceletia crypta* from the Great Barrier Reef (Australia) and subsequently sequenced. Archaeal 16S rRNA was PCR-amplified, but not yet successfully sequenced. The phylogenetic analysis of microbial community of *V. crypta* revealed a high diversity and a complex composition with a relatively homogeneous phylogenetic distribution. The most abundant were the green non-sulfur bacteria –*Thermomicrobia/Chloroflexi* (17%). Over 50% of the microbial community consisted of the *Gammaproteobacteria, Gemmatimonadetes, Actinobacteria, Nitrospira, Acidobacteria* with nearly equal participation. Less abundant members of the microbial community belonged to the *Deltaproteobacteria* (6%), *Nitrospina* (6%), as well as the *Alphaproteobacteria*, *Poribacteria, Betaproteobacteria,* Cyanobacteria, Spirochaetes, and *Deinococcus-Thermus* (in total 11%). 9% of the sequences from *V. crypta* were assigned to the group of „uncultured bacteria", which enclosed unidentified bacteria diverse from all hitherto characterised and described microorganisms. 95% of the sequences were closely related with other sponge-derived sequences, what underscores that the „living fossil" coralline sponge *Vaceletia* shares features of its microbial community with other sponges.

Symposium C – Vortrag/oral presentation

Phylogenetic diversity of microbial symbionts in the coralline sponge *Astrosclera willeyana* from distant geographical regions (Red Sea-Egypt versus Great Barrier Reef-Australia)

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The coralline sponge *Astrosclera willeyana*, considered as a living representative of reef-building stromatoporoids of the Mesozoic and the Palaeozoic, is widely distributed throughout the Indo-Pacific, from the Red Sea to the Society Islands. Despite of intensive research on symbiotic microorganisms in sponges, the microbial diversity in coralline sponges, unique members of Phylum Porifera, was never investigated using culture-independent molecular methods. The aim of the study was to examine, if *Astrosclera* from separated geographical regions host similar microbial communities, what is specific for recent sponges from different oceans. Random sequencing of two 16S rDNA clone libraries constructed from single specimens of *Astrosclera willeyana* from the northern Red Sea (Egypt) and the Great Barrier Reef (GBR) (Australia) revealed complex microbial communities in both samples, sharing significant features. In total 366 and 414 clones were sequenced from the GBR and the Red Sea specimens, respectively. The phylogenetic distribution of sequences in both sponges was relatively uniform, characteristic for microbial communities with high diversity. Slightly higher diversity was found in *A. willeyana* from the Great Barrier Reef, where the Poribacteria, Cyanobacteria and Archaea additionally occurred (each 1%). In both samples, the green non-sulfur bacteria – Thermomicrobia/Chloroflexi (20% Egypt and GBR) were the most abundant, as well as the Gammaproteobacteria (19% Egypt, 13% GBR), and the Actinobacteria (10% Egypt, 13% GBR). The Deltaproteobacteria were more abundant in the Red Sea specimen (13% Egypt, 8% GBR), whereas the Nitrospirae showed reversed occurrence (7% GBR, 4% Egypt). The Acidobacteria and Alphaproteobacteria (about 9% each), as well as the Gemmatimonadetes, Nitrospina, and Spirochaetes (in total 8%) were found in both samples with similar abundance. Over 90% of sequences obtained from *Astrosclera willeyana* from both geographically separated areas clustered together with other sponge-derived sequences, highlighting the uniqueness of the microbial consortia in sponges. The remaining sequences were similar to sequences from uncultivated organisms, particularly from marine environments. None of the sequences were closely related to validly described microorganisms. In both *Astrosclera* samples about 8% of the sequences was affiliated to the group of „uncultured bacteria" of undefined affiliations, which indicate new unspecified microorganisms with unknown physiological potential.

Symposium F – Poster

The Insectivora of Petersbuch 28

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Petersbuch near Eichstätt is a large area containing many karstic fissure fillings in Jurassic limestone, yielding large amounts of different taxa from the Oligocene to the Pleistocene. Despite the fact that a stratigraphic placement is challenging, single fissures can be regarded as containing only one time span; in others, mixing can be shown. In Petersbuch 28, no mixing is known thus far; it seems to belong to a larger system of MN3/MN4 fissures.

Species richness: Total 17 taxa (Marsupialia: 1, Erinaceidae: 2, Dimylidae: 4 (3 *Plesiodimylus*), Talpidae: 4, Soricidae: 6.

The Soricidae are dominant in numbers, with *Soricella discrepans* being more frequent than all other Soricids together, making up 25 % of the total fauna. The most common taxon is *Plesiodimylus*, making up 29 %, with numerous lower molars, the majority of which cannot be determined to the species level. *Desmanella engesseri* is present with only 11%, followed by *Miosorex* with 7 %, *Lartetium petersbuchense*, *Myxomygale hutchisoni* and *Chainodus intercedens*, which makes up 4 % of the total fauna. Less than one hundred specimens are present of *Amphiperatherium frequens*, *Galerix aurelianensis*, *Florinia stehlini* and *Paenelimnoecus micromorphus*, respectively. The fewest in numbers are *Heterosorex neumayrianus*, present with 31 specimens, *Desmanodon antiquus* with 7 specimens and *Mioechinus* sp., represented by two teeth only. *Talpa* is only known by the humeri.

The preliminary interpretation of the palaeoenvironment is that of a forested, rather wet area, because of the numerous occurrences of Dimylids and the predominance of Soricids; also *Amphiperatherium* is an indicator of forests. The Erinaceinae are thought to be animals of more arid habitats, which holds true for *Galerix* to a lesser degree.

The fauna is interpreted as belonging to MN3/MN4; it should therefore be placed into MN4 considering the faunal list. Nevertheless, *Galerix aurelianensis*, *Desmanella engesseri*, *Myxomygale hutchisoni* and *Desmanodon antiquus* were all described from MN3/MN4. Also, *Plesiodimylus huerzeleri* is known from M3 only, being replaced by *P. chantrei* in MN4. All other species are also known from MN3 and MN4, sometimes even from MN5. The whole fauna seems to belong to the upper most part of MN3 and the early part of MN4.

Freie Themen – Vortrag/oral presentation

Defining stem-lineage neoselachians (Synechodontiformes): Implications for the origin and evolution of modern sharks and rays

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The well-defined monophyletic clade Neoselachii (living sharks, rays, and skates) is one of the most successful groups of chondrichthyans, but their definition rests solely of living members. Fossil taxa are only considered to be neoselachians, if they are nested phylogenetically within a living clade. The systematic position of most extinct sharks is unresolved and remains one of the major challenges in reconstructing the phylogeny and evolutionary history of sharks in general. Although great progress has been accomplished in the last years resolving the interrelationships of Neoselachii, a comprehensive phylogeny identifying the systematic position of problematic or entirely fossil taxa is still lacking. Especially, our understanding of early neoselachian diversities, taxonomies, and systematics are still very inadequate. This mainly is related to the nature of preservation, because neoselachian skeletons are mostly cartilaginous and consequently become scarcely and only under exceptional taphonomic conditions fossilized. Isolated material, such as teeth, placoid scales or fin spines, conversely, is quite resistant and very abundant as fossils. Neoselachian teeth are generally considered to be useful for taxonomic purposes. However, the precise study of tooth morphologies including ontogenetic and sexual dimorphisms, which only is possible in combination with fossilized skeletal elements, generally is the most reasonable way to establish systematically useful tooth characters for inferring interrelationships and diversity patterns through time.

Among the wide array of fossil neoselachian taxa reported from the Early and Late Jurassic is one group of sharks, traditionally assigned to Synechodontiformes, which includes abundant taxa mostly based on isolated teeth. Although ranging from the Late Permian to the Thanethian and reported from the northern as well as the southern hemispheres, they are a largely disregarded group of early modern sharks, whose importance for the evolution of neoselachians was unrecognized until recently. Their inter- and intrarelationships are ambiguous and their monophyly and systematic position within Elasmobranchii was debated for decades due to dental similarities, scarcity of skeletons and lack of comparable extant taxa. In recent years, several holomorphic specimens were discovered allowing a reassessment of these problems. Recent phylogenetic analyses employing robust cladistic principles for the first time allowed evaluating their monophyly and interrelationships. According to these results, Synechodontiformes is monophyletic including four well-supported clades and some taxa of uncertain relationships. They display a suite of neoselachian characters but form the sistergroup of all living sharks. Consequently, the framework of neoselachian systematics needs to be expanded to include not only living (crown-group) but also extinct clades (stem-group). According to the synechodontiform fossil record, the origin of Neoselachii can be traced back into the Permian with certainty.

Freie Themen – Poster

Interspecific variation or sexual dimorphism: is early neoselachian diversity an artefact or substantial?

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Identifying the interrelationships of extinct neoselachians is one of the major challenges in reconstructing the evolutionary history of sharks in general. Although great progress has been accomplished resolving the systematic positions of their living relatives, a comprehensive phylogeny, including fossil taxa is still lacking. This discrepancy is related to the nature of preservation. Extinct forms are generally known from isolated teeth only, whereas skeletal remains are very scarce throughout their evolutionary history. Consequently, a tooth-based taxonomy was established largely excluding articulated material. Nevertheless, only little is known about the nature of odontological differences in closely related taxa. For instance, possible ontogenetic or sexual dimorphisms are generally ignored although tooth differences related to these phenomena are common in extant sharks, rays and skates. Dental sexual dimorphism in fossil neoselachians has not yet been scrutinized in detail and hence the origin of this feature is completely unknown. Recent analyses of the early Jurassic shark *Palidiplospinax*, a member of the neoselachian stem-lineage-group Synechodontiformes, provide the first direct evidence of dental sexual dimorphism in a plesiomorphic shark. Comparison with other synechodontiforms (e.g. *Paraorthacodus* from the Late Jurassic) supports the interpretation that this feature is commonly present in early neoselachians. Analysing the dentition of those species in detail combined with skeletal features will provide deeper insights into the sexual variability, which subsequently will be transferred to tooth taxa. The results will strongly contribute to a better knowledge of neoselachian taxonomies based on dental characters and thus provide deeper insights into the plesiomorphic neoselachian condition and character evolution.

Freie Themen – Poster

Antiquity and origin of angel sharks (Chondrichthyes, Squatiniformes)

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The origin and fossil record of the living angel (or devil) shark is ambiguous. So far, 22 living species have been described, which are all assigned to a single genus, *Squatina*, and family, Squatinidae, respectively. They are ray-like, benthic sharks of moderate body size (total length about 1–2 m) with enlarged pectoral and hypocercal caudal fins but without anal fin. They form together with dogfish sharks (Squaliformes) a monophyletic group, which is characterized by the presence of a distinct palatoquadrate process, which extends into the orbit.

The incomplete nature and patchiness of the fossil record of squatinids, which mainly consists of isolated teeth makes it difficult to reconstruct their evolutionary history. Until recently, it was assumed that the fossil record of the living angel shark, *Squatina*, extends back into the Kimmeridgian based on dental similarities of holomorphic fossils from the Late Jurassic Solnhofen plattenkalks and molecular clock approaches. Nevertheless, dental similarities between living and Jurassic squatinids only are superficial and numerous skeletal features support the interpretation that Jurassic squatinids belong to a distinct taxon, *Pseudorhina*, which is extinct and sister to *Squatina*. Here, we present a revision of fossil squatinids based on holomorphic specimens or identifiable skeletal remains to provide a solid basis for interpreting the fossil record of *Pseudorhina* and *Squatina*. Additionally, we accurately date the occurrence of extinct members of the genus *Squatina* and their closest relatives using the fossil record and aspects of phylogenetic bracketing for providing reliable age estimates for the origin of squatiniforms and *Squatina*, respectively. Results of this study are: (1) all holomorphic Late Jurassic squatinids belong to *Pseudorhina*, which is sister to *Squatina*; (2) the origin of Squatiniformes and thus of *Squatina* was in the earliest Late Jurassic; (3) no reliable Late Jurassic record of *Squatina* have been found up to date indicating that the dental differences between Late Jurassic squatinids were very subtle; (4) there is a gap in the fossil record of squatinids ranging from the early Tithonian to the Valanginian; (5) the fossil record of the living angel shark, *Squatina*, reliably extends back into the Aptian based on identifiable skeletal remains; (6) identification of rare squatinids from the Valanginian – Aptian remains ambiguous; (7) there is no reliable post-Jurassic record of *Pseudorhina*.

Symposium D – Vortrag/oral presentation

Pflanzen-Insekten Interaktionen und klimatische Korrelationen im Unter-Oligozän von Mitteleuropa

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Untersuchungen an Pflanzen – Insekten Interaktionen ermöglichen neue, wissenschaftlich wertvolle Erkenntnisse, die über die jeweiligen botanischen und entomologischen Wechselwirkungen hinaus, auch über paläoklimatische und -ökologische Fragestellungen Auskunft geben. Im Paläogen entstanden viele der heutigen Pflanzen - Insekten Assoziationen, wie an Beispielen aus Nord Amerika und Europa bereits nachgewiesen wurde.

In der vorliegenden Studie wurden fossile Blätter aus zwei unteroligozänen Fundstellen in Mitteleuropa (Seifhennersdorf, Deutschland; Kundratice, Tschechien) auf Pflanzen-Insekten Interaktionen untersucht. Die Fundstellen liegen im České středohoří Vulkan Komplex, in denen diatomitische Sedimente, Vulkanoklastika und Tuffe anstehen. Durch radiometrische Untersuchungen konnten die Aufschlüsse auf das frühe Oligozän datiert werden (32 – 30 Ma).

Insgesamt wurden 5893 Blätter von 94 Angiospermen-Arten untersucht und 38 Fraßspuren nachgewiesen. Fraßfrequenz, -diversität und –zusammensetzung wurden jeweils für beide Gesamtfloren und einzelne Pflanzenarten mit mehr als 20 Blättern erhoben. Etwa 9,3% der Blätter aus Seifhennersdorf und 33,9% der Blätter aus Kundratice weisen Fraßspuren auf. Für Seifhennersdorf wurde von früheren Autoren eine Mittlere Jahrestemperatur von ca. 15,8°C rekonstruiert, für Kundratice liegt die Temperatur bei ca. 17,4°C.

Quantitative Korrelationen zwischen Insektenfraß, Temperatur und Pflanzendiversität wurden mithilfe statistischer Verfahren ermittelt. Zudem konnten durch die Untersuchungen an den Blattfossilien aus Seifhennersdorf und Kundratice die Auswirkungen und die Dynamik der Pflanzen – Insekten Interaktionen nach dem signifikanten globalen Klimawandel am Ende des Eozäns sehr genau nachvollzogen werden.

Der bis jetzt erhobene Datensatz aus dem Oligözan von Europa mit Werten aus Kundratice, Seifhennersdorf, Enspel (24,56 – 24,79 Ma) und Rott (18,3 – 20,8 Ma) kann nun als Grundlage für Untersuchungen der Abhängigkeiten zwischen Temperatur und Insektendiversität genutzt werden.

Symposium D – Poster

Fossile Prokaryoten in mesozoischen und känozoischen Bernsteinen

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In Bernsteinen sind Arthropoden, Protozoen, Bakterien, Pilze sowie Reste von Pflanzen in oft exzellenter Weise erhalten. Prokaryoten zählen zu den häufigsten, jedoch bisher am wenigsten beachteten Bernsteineinschlüssen. Ziel unserer Studie war es, prokaryotische Einschlüsse in meso- und känozoischen Harzen zu dokumentieren und zu charakterisieren sowie Aussagen zu deren Taphonomie und Erhaltungszustand zu machen.

Triassische, kretazische und känozoische Bernsteine Eurasiens und Nordamerikas wurden licht- und elektronenmikroskopisch untersucht. An frischen Bruchflächen wurden zudem Röntgenmikroanalysen durchgeführt.

Es konnten verschiedene Morphologien prokaryotischer Organismen unterschieden werden. Vor allem in kretazischen Harzen finden sich häufig fadenförmige prokaryotische Inklusen. Die reich verzweigten Filamente bestehen aus stäbchenförmigen Zellen, die meist von einer etwa 10 µm dicken granulierten Scheide umgeben sind. Morphologisch ähneln diese Organismen daher der rezenten aquatischen Gattung *Leptothrix* (Proteobacteria). Diese Fäden konzentrieren sich besonders im randlichen Bereich der Harzstücke und lassen diese daher opak erscheinen. Mehrere Merkmale deuten auf ein Wachstum dieser Prokaryoten in das ehemals flüssige Harz hinein. Dies sind (1) die Konzentration dieser Inklusen in den äußeren Bereichen der Bernsteinstücke, (2) die Wachstumsrichtung von außen nach innen, (3) die Orientierung der apikalen Bereiche der Fäden in verschiedene Richtungen und (4) das Fehlen beschädigter Filamente. Offensichtlich waren die fadenförmigen Prokaryoten in der Lage, das viskose Harz von außen nach innen zu besiedeln. Das Wachstum stoppte, sobald sich die Harzstruktur verfestigte, wobei die Filamente exzellent konserviert wurden. Die Mikroorganismen kamen vermutlich in humiden terrestrischen oder limnisch-terrestrischen Lebensräumen mit dem noch viskosen Harz in Kontakt und nutzten es als temporäres Mikrohabitat. In heutigen Wäldern werden viskose Harzkörper vor allem von resinicolen Pilzen (Mycocaliciales, Ascomycota) besiedelt.

Im Gegensatz zu den oben beschriebenen Prokaryoten sind Cyanobakterien in fossilen Harzen sehr selten und offenbar ausschließlich als Fragmente mikrobieller Matten in das Harz gelangt. Von einem Wachstum dieser photoautotrophen Organismen im Harz kann nicht ausgegangen werden.

Symposium F – Vortrag/oral presentation

Hypsodonte Säugetierzähne klassifiziert als heterochrone Bildungen

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In die neue Klassifizierung von hypsodonten Säugetierzähnen können alle Zähne eingefügt werden, die in der Wachstumsrichtung verlängert sind, unabhängig von ihrer Position im Gebiss und unabhängig von einer Schmelzbedeckung. Damit wird der Begriff „hypsodont“ sinnvoll erweitert. Drei unabhängige Merkmalskomplexe fließen in die Gliederung ein: 1. die spezielle Phase der Zahnbildung, durch deren heterochrone Verlängerung die Hypsodontie verursacht wird, 2. der Grad der Hypsodontie und 3. das Verhältnis von Abrieb und Zahn-Eruption. Der erste Aspekt ist der wichtigste und auf ihm basieren die hier aufgestellten Kategorien der Hypsodontie.

Im ersten Merkmalskomplex wird die Bildung des Zahnes in fünf zeitlich aufeinander folgende ontogenetische Phasen geteilt: 1. Zahnoberfläche mit Höckern, 2. Seitenwände, 3. Unterrand der Schmelzkrone, 4. Zahnhals aus Dentin, 5. Differenzierung der Wurzeln. Hypsodonte Zähne werden nie durch die gleichmäßige Verlängerung aller Phasen gebildet, sondern stets nur durch die Verlängerung von einer der Phasen, wobei die anderen in unterschiedlicher Weise reduziert werden. Diese idealisierten Phasen können sich in der Realität aber auch stellenweise zeitlich überlappen. Dennoch können vier Kategorien der Hypsodontie unterschieden werden:

1. Höcker-Hypsodontie (z.B. Molaren der Elefanten und Warzenscheine),
2. Seitenwand-Hypsodontie (z.B. Molaren von Pferden und Wühlmäusen),
3. Schmelzband-Hypsodontie (z.B. Schneidezähne von Nagern und Hasen) und
4. Dentinzähne (Molaren der Xenarthra und Stoßzähne der Proboscidea).

Eine Vergrößerung differenzierter Wurzeln hat nie zur Hypsodontie geführt.

Der zweite Merkmalskomplex beschreibt die Steigerung der Hypsodontie bis zur Wurzellosigkeit, die mehrfach unabhängig evoluiert. Im dritten Merkmalskomplex werden zwei ganz un-

terschiedliche Erscheinungsformen unterschieden. Bei der einen Form bleibt die Kaufläche in einer stabilen Position, weil Abrieb und Nachschieben in einem exakten Gleichgewicht stehen. Beispiele sind die Molaren der Pferde sowie die Incisiven der Nager. Bei der zweiten Erscheinungsform wird das Wachstum der Zähne nicht durch einen Antagonisten begrenzt, so dass die Zähen sehr lang werden können, wie bei den Eckzähnen vieler Raubtiere oder den Stoßzähnen der Elefanten. Die hauptsächliche Funktion liegt bei der ersten Form bei der Zerkleinerung der Nahrung, bei der zweiten treten soziale Interaktionen hinzu.

Mit diesen drei Merkmalskomplexen kann die große Vielfalt der hypsodonten Zähne beschrieben werden, wobei es nicht um eine möglichst feine Typisierung geht, sondern um das bessere Verständnis der Zahnmorphologie. Bei Betrachtung der Bildungsweise geben sich viele phylogenetische Veränderungen als heterochrone Verschiebungen der ontogenetischen Phasen zu erkennen.

Symposium J – Poster

The Madygen lake deposits: A unique multi-taxa kindergarten for Triassic fishes?

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Lacustrine mudstones at the type locality of the Middle to Late Triassic (Ladinian–Carnian) Madygen Formation (Turkestan Mountains, SW Kyrgyzstan, Central Asia) have yielded a diverse fish fauna including six genera of actinopterygians, a dipnoan, and two sharks. A remarkable feature of this ichthyofauna is the abundance of specimens with a relatively small body size.

Asiatoceratodus sharovi, the only known lungfish from the study area, measures up to 30 cm in size, which is less than a third of the length of comparable ceratodontoids. Specimens of *Saurichthys orientalis* from the Madygen Formation range between 20 and 45 cm in total length. This is in contrast to many other records of saurichthyids with often 1.0-1.5 m long fully grown individuals. Measured or projected body size of most of the remaining actinopterygians from Madygen does not exceed 10 cm. About one third of these specimens display incomplete squamation, classifying them as juvenile individuals. The same conclusion concerns small specimens whose scales show a much weaker ganoin layer than isolated found scales of homotypic ornament. Sharks of the Madygen Formation are represented by two types of egg capsules (*Palaeoxyris* sp., *Fayolia* sp.) and hybodont teeth (*Lonchidion* sp.). The majority of teeth measure around 1 mm in mesodistal length and can thus be referred to immature individuals.

These data suggest that deposits of the Madygen Formation partly conserved Triassic multi-taxa spawning and nursery grounds. Such habitat partitioning behavior is well known from various recent fishes: e.g., some marine shark species show habitat selection for the young in order to avoid conspecific predators. The shark pups remain in the nurseries until they reach an appropriate size to join the adult stock. The occurrence of most likely juvenile hybodont teeth (*Lonchidion*) and hybodont egg capsules (*Palaeoxyris*) in near-shore lake deposits of the Madygen Formation suggests that mature females preferred vegetated shallow water zones of the lake margin or discharging streams for spawning. Juveniles of recent marine and freshwater actinopterygians often populate areas of shallow water-depth and/or dense macrophytic vegetation for shelter; the same could be true for the Madygen actinopterygians.

The minimum lateral extent of the Triassic Madygen lake at the type locality of the Madygen Formation was 1.7 km. Scattered outcrops of stratigraphically equivalent deposits along the southern margin of the Fergana Valley (Kyrgyzstan, Tajikistan, Uzbekistan) await detailed study. So far, we can neither exclude that the Madygen lake extended over tens of kilometers nor that it had a fluvial connection to the far distant Tethys ocean. In this respect, the known outcrops might record only the marginal facies of a much larger lake or lake system used by chondrichthyans, actinopterygians, and possibly lungfishes as spawning and nursery grounds.

Symposium J – Poster

Testing a nanometrological technique for morphometric analysis of actinopterygian teeth

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Isolated actinopterygian teeth are abundant in marine and freshwater deposits. Their systematic attribution is often problematic, and most of them are considered as unspecific. An exception are teeth with a characteristic pattern of longitudinal ridges and furrows, commonly found in Triassic strata and attributed to the genera *Saurichthys* and *Birgeria*. Several species of these genera have been based exclusively on tooth morphology, but attempts to define a „saurichthyid" and a „birgeriid" morphotype have led to contradictory results.

We intend to develop a method of morphometric classification of isolated actinopterygian teeth. Morphometric criteria should comprise parameters such as relative height and depth of sculptural elements, curvature of the longitudinal profile and variation in cross section. This objective requires a 3d measurement approach applicable for complete jaws as well as for single teeth. The comparability of measurements is difficult to achieve because isolated teeth can easily be studied e.g. using REM, whereas bigger specimens cannot. Moreover, the surface structure of teeth in articulated jaws is often obscured by substances needed to protect the fossils from mechanical destruction. Thus, only non-contact measurement methods can be used for assessing the surface morphology. Stereo photomicrography and image analysis appears to be a solution, but its possibilities are limited by the topography of the jaw and

layers of protective material.

Isolated teeth and jaw portions of *Saurichthys, Saurorhynchus* and *Birgeria* were analyzed with the white light interferometer WYKO NT1100. This system figures and measures the surface topography by means of the interference of light reflected by it. It is able to work both in a vertical scanning mode and in a phase-shifting (PSI) mode, which is important to achieve maximum vertical measuring range and maximum resolution. The maximal horizontal resolution that can be achieved in both modes with a 20 times magnifying objective is 409 nm. In the PSI mode it is possible to reach a vertical resolution of 0.1 nm. The apparatus includes an automatic moving table which allows to measure surface mosaics as large as 100 × 100 mm.

Measurement approaches with a beam of visible light have many advantages compared to traditional profilometers, namely a short measurement time and a vertical resolution close to the Atomic Force Microscopes (AFM). However, problems could appear with diffraction of light waves in narrow slots resulting in a faulty image. The system requires the recollection of a minimum of 20% of the emitted measuring beam (in case of magnification 5×) in order to deliver a useful result. This level may not be reached for the measurement of porous surfaces, surfaces with large declination of the asperities slopes, and surfaces of dark color.

Symposium I – Poster

The palaeohistology of the basal ichthyosaur *Mixosaurus* Baur, 1887 (Ichthyosauria, Mixosauridae) from the Middle Triassic: palaeobiological implications

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The ichthyosaur *Mixosaurus* (Baur 1887) is among the most common faunal elements in the middle Triassic locality of Monte San Giorgio, Switzerland. The preservation at this site is exceptionally good, and specimens of different ontogenetic stages are preserved. A series of five humeri of *Mixosaurus* was studied histologically, including a humerus belonging to a small individual of about 50 cm in body length, three intermediate-size specimens (100-120 cm), and a larger one of 150 cm body length. Body length estimates are based on comparisons with complete skeletons of *Mixosaurus* housed in the Palaeontological Museum of the University of Zurich. Additionally, one femur, one fibula, one ischium, as well as various bones of the zeugo- and autopodium of *Mixosaurus* were sampled. This is the first examination of an ontogenetic series of a basal ichthyosaur.

Growth marks are present in the humeri, the femur, and the fibula, as well as in other skeletal elements (e.g., ribs or gastral ribs). Ontogenetic changes are traceable throughout stylo- and zeugopodial development, but interior remodelling and resorption vanished part of the internal growth record in the primary cortex. Other skeletal elements which show less resorption in *Mixosaurus*, i.e., ribs or gastral ribs, provide alternative counts of growth cycles, which can be compared to the lines of arrested growth (LAG) found in the stylo- and zeugopodium. The presence of Sharpey's fibers in the cortex of both stylo- and zeugopodial elements indicates strong muscle and tendon attachment.

Mixosaurus humeri start as flat structures consisting of a core of endochondral woven bone and residual calcified cartilage, and growth continues by deposition of periosteal fibrolamellar bone. Only a single LAG is present in the smallest sampled humerus, indicating that the animal was in its second year of life. Taking into account the number of LAGs and the assumption that absorbed zones might have been larger in the faster growing juveniles, the largest individual investigated might have reached an age between 15 and 16 years.

Unlike the fast-growing post-Triassic ichthyosaurs that lack growth marks in their bones due to intense remodelling, microstructural and life history data are now becoming available for a basal taxon of ichthyosaurs.

Symposium D – Vortrag/oral presentation

A quantitative model linking palaeoenvironment and plant ecophysiology

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Plants try to minimise transpiration while maximising assimilation. These are conflicting tasks, because stomata, the pores for gas exchange, are permeable for CO_2- as well as for H_2O-molecules. Since plants can actively open and close their stomata, they are able to achieve a compromise in this conflict by dynamic regulation.

We present a mathematical model which quantifies these effects. The model comprises a systematic derivation of the relation between plant transpiration, assimilation and atmospheric CO_2-concentration based upon (i) a quantitative model of C_3-photosynthesis, (ii) the physics of diffusion, and (iii) an optimisation principle which asserts that plants adjust stomatal conductance in such a way that assimilation is maximised and transpiration is minimised. It has been verified that extant plants behave according to this optimisation approach. Since stomatal conductance is related to plant leaf anatomy the model leads eventually to epressions for stomatal conductance, transpiration rate and assimilation rate in terms of variables representing (a) the environment (atmospheric CO_2-concentration and humidity, leaf temperature, soil water content, soil properties, solar insolation, wind velocity), (b) leaf anatomy, and (c) photosynthesis.

Since the model is formulated in terms of analytic functions, it can easily be used to predict (or, in a palaeobotanical context, to reconstruct) the result of variations of the enviromental and anatomical parameters noted in (a) and (b) on physiological important quantities such as transpiration rate and assimilation rate and *vice versa*.

One application of the optimisation model starts from a

physiologically defined „viability space" of a plant (defined e.g. in terms of transpiration and assimilation rate ranges preferred by the plant). The model allows then to calculate the ranges of environmental variables like temperature, atmospheric humidity or soil moisture compatible with this „viability space". Varying also atmospheric CO_2, it turns out that plants that require humid conditions under low CO_2 may be able to flourish under much drier conditions (and within a somewhat wider temperature range) if CO_2 is high.

Another model application strongly suggests that attempts to reconstruct palaeoatmospheric CO_2 from stomatal densities of fossil leaves alone can produce rather misleading results. Unequivocal reconstructions require additional knowledge of (at least) palaeotemperature, atmospheric humidity and soil moisture.

Symposium B – Keynote

Macroevolution and macroecology of mollusc-dominated benthic associations

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Molluscs represent one of the most abundant and diverse groups of metazoan fossils. They are present throughout the entire Phanerozoic, thrive at all trophic levels, and inhabit a wide range of environments, from deep sea to alpine tundra. Moreover, most molluscs posses multiple qualities coveted by palaeontologists. They often secrete biomineralized shells with taxonomically and ecologically informative morphologies, bear traces of predation such as drillholes or repair scars, and yield high-resolution geochemical signals that can serve as unique climatic and environmental proxies. Also, counting molluscs is relatively straightforward compared to many other fossil groups. That is, their mode of life is typically solitary, they do not molt, they usually possess single-element or two-element skeletons, and their skeletal elements do not transform upon death into a heap of countless plates and spines. Not surprisingly, fossil molluscs have been, are, and will likely remain, one of the foremost targets for large-scale quantitative studies of the fossil record.

Those numerous informative virtues of molluscs have been exploited by many researchers interested in various aspects of macroecology and macroevolution. Using post-Palaeozoic benthic molluscs, our research group have observed that (1) sample-level diversity of molluscs changed notably through time, although several taphonomic and methodological biases complicate literal interpretations of those patterns; (2) intensity of predation and diversity may have co-varied through time, although (again) a process-based interpretation of this observational pattern is ambiguous; and (3) dominance in mollusc benthic associations appears to have been driven by their ecology rather than phylogeny. These inductive, pattern-oriented empirical efforts highlight the value of fossil molluscs as a source of quantitative palaeontological data. However, so far, these efforts have not been satisfactorily adequate in addressing fundamental questions regarding causative mechanisms that have shaped phylogeny, diversity, and ecology of molluscs through their evolutionary history.

Symposium D – Vortrag/oral presentation

Wie gräbt man einen versteinerten Wald aus? Paläobotanik aus Ingenieurssicht

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Es bedurfte Generationen von Forschern um zu realisieren, dass sich unter Chemnitz nicht nur eine Fossillagerstätte, sondern ein teils noch in Wuchsposition stehender, durch vulkanische Aktivitäten verschütteter, etwa 290 Mill. Jahre alter Wald befinden könnte. „Bewaffnet" mit dieser These sollte es 2008 für das Team des Museums für Naturkunde daran gehen, diesen T_0-Horizont auf einem kleinen Gelände in Chemnitz-Hilbersdorf freizulegen.

Was auf den ersten Blick simpel erscheint, erweist sich bei genauerer Betrachtung als interdisziplinäre Herausforderung, für welche die „traditionelle" Paläobotanik leider keine Lösungsansätze bietet. Aufgrund fehlender Standards und Erfahrungen kann es bereits beim Versuch, einen T_0-Horizont durch eine Grabung zu identifizieren, zu einem erheblichen Datenverlust kommen, obwohl die Fossilien dabei geborgen werden. Gerade in Schichten, in welchen Raum und Zeit gleichermaßen „eingefroren" wurden, macht es sich zwingend erforderlich, die dreidimensionale Lage der Fossilien und weitere wichtige Daten praxisnah zu dokumentieren. Eine vergleichbare Vorgehensweise hat glücklicherweise in der Archäologie eine vorbildliche Optimierung erfahren. Daher wurde in Anlehnung an deren Grabungsabläufe ein Gesamtkonzept zur Datenerhebung entwickelt, welches aufgrund umfangreicher Funde und Erfahrungen jedoch immer wieder an die „Grabungsrealitäten" angepasst werden musste.

Ausgehend vom Wissensstand vor Grabungsbeginn wird unsere Vorgehensweise für jede angetroffene Schicht einschließlich gewonnener Erfahrungen erläutert. Bemerkungen zu organisatorischen Dingen und praktische Tipps runden den Bericht ab. Es handelt sich ausschließlich um Betrachtungen zur Grabungsmethodik, rein paläobotanische Aspekte sind nicht Gegenstand der Ausführungen.

Symposium H – Vortrag/oral presentation

Of genes and fossils: Reconstructing adaptive processes in dog-fish sharks

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Dogfish sharks (Squaliformes) constitute a monophyletic group of predominantly deep-water sharks, but the reasons and timing of their adaptation to this hostile environment remain ambiguous. The fossil record of dogfish sharks mainly consists of isolated teeth with very rare complete skeletons and does not provide any direct evidence for assessing the timing of their origin, cladogenetic events or adaptation to deep-water environments. To bring new perspectives to these questions, we constructed, dated, and analysed a genus-level supertree of extinct and extant taxa and performed molecular analyses of living Lantern Sharks (Etmopteridae) to infer the node age of the split between dogfish sharks, in which bioluminescence occurs (Etmopteridae and Dalatiidae).

For the supertree, eleven partial source trees of dogfish shark interrelationships were merged into a comprehensive phylogenetic hypothesis. The resulting supertree is the most inclusive estimate of squaliform interrelationships based on combined morphological and molecular data and contains 23 fossil and extant members of all major groups. The most conspicuous result is that both groups of living dogfish sharks, which developed bioluminescence, belong to a monophyletic group, the Dalatoidea, indicating that this pattern evolved only once but followed different evolutionary pathways. According to the dated supertree, bioluminescence in dogfish sharks already might have been developed in the lowermost Late Cretaceous (ca. 100 Mya) at the earliest. The phylogenetic hypothesis based on the supertree further was used to establish the quality of the fossil record, which was reassessed using the simple completeness metric as an independent measure. Although different (48% and 61%, respectively), both measures indicate that the fossil record of squaliforms is very incomplete. Gaps in the fossil record range from 5 to 100 million years. The most basal group within Squaliformes comprises the living dogfish, *Squalus*, which is a major target in commercial fisheries, and †*Protosqualus.* Our results suggest a post-Jurassic origination of squaliforms in shallow waters of the northern Tethyal margin.

We also compiled an extensive DNA data set of etmopterid sharks, which is the most specious but still less-known family of bioluminescent sharks within Dalatoidea. Maximum likelihood, Bayesian and Most Parsimonious analyses performed in this project were based on 4685 bp of both nuclear (RAG1) and mitochondrial genes (COI, 12S-partial 16S, tRNAVal and tRNAPhe). In addition to 43 etmopterid species, representatives of Centrophoridae, Oxynotidae, Somniosidae, Dalatiidae, and Squalidae as well as Echinorhinidae were included in our analyses. We used a set of five comparatively undebatable fossil calibration points including articulated fossils from the Late Cretaceous of Lebanon for dating the origin of squaliform sharks and adaptive events in the evolutionary history of dogfish sharks. The results of these analyses support that squaliforms originated in the late Early Cretaceous (ca. 129 Mya). The split between etmopterids, dalatiids and „somniosids" is dated at ca. 67 Mya. Thus, bioluminescence might have evolved shortly before the K/P boundary event. This age estimate differs from that of the supertree (100 vs. 67 Mya) and might be related to the selection and taxonomic interpretation of fossils for node age estimates. Etmopteridae evolved between 69 and 53 Mya. The origin of genus *Etmopterus* occurred between 48 and 36 Mya with further radiation events in the Late Eocene (ca. 36 Mya) and Miocene (14 Mya).

Adaptation of dogfish sharks to deep-water environments probably was a two-step evolutionary process and the adaptive process was random and a consequence of luminescence. Luminescence probably evolved as camouflage by counter-illumination of squaliforms predominantly living in the photic zone. The ultimate reasons for migration into the deep-sea environments, however, still remain ambiguous.

Freie Themen – Poster

Shark, rays and skates (Chondrichthyes, Neoselachii) from the Ottnangian of South Germany: Implications for neoselachian diversity of the Miocene Molasse Basin

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The Molasse Basin represents a foreland basin, which evolved as marginal sea of the Paratethys in the Oligio-Miocene during the Alpine-Himalayan orogeny and in which the conglomerates and sandstones were deposited as a result of erosion and denudation of the developing alps. The sediments of the South German Molasse Basin range in age from the Late Eocene to the Late Miocene. Traditionally, the sediments are subdivided into two transgressive-regressive megacycles, each starting with a marine sequence. Elasmobranch remains are quite common in these marine deposits, especially in Miocene deposits and have been subject of numerous studies since the middle of the 19th century. Nevertheless, the taxonomic diversity of Marine Molasse sharks remains incompletely known. Here, we present a diverse elasmobranch fauna from the Auwiesholz Member of the Achen Formation in the Simsee area (Bavaria, S. Germany) consisting of near-shore and pelagic sharks and batoids. The Achen Formation is of Middle Ottnangian age, Early Miocene (ca. 17.8 Ma) and denotes the second cycle of the Upper Marine Molasse in Bavaria. The depositional area represents an inner neritic environment basally, which deepens upwards. This fauna is more or less the same age as the famous one described from the Baltringer Horizon

in Baden-Württemberg and allows a taxonomic re-evaluation of Miocene sharks of the Molasse Basin. Faunal relationships with more or less contemporaneous elasmobranch faunas in the Mediterranean (e.g. Montpellier region), Swiss Molasse, Vienna Basin and Eastern Paratethys are established based on qualitative (presence/absence) data and were calculated using the Jaccard coefficient of Community and the Simpson Index. Additionally, the beta diversity of Miocene Molasse selachians is used to characterize the taxonomic differentiation between localities and regions. The more different the faunal compositions are, the higher is the beta diversity. The overall pattern that emerges indicates that the taxonomic composition of selachians is more or less the same throughout the Paratethys. Selachian faunas of the Paratethys are a mixture of shallow marine, near-coastal and pelagic (oceanic) taxa. Local differences are mainly related to different environmental settings or might represent collecting biases.

Symposium E – Vortrag/oral presentation

Late Cretaceous conifer diversity: new data from the Maastrichtian flora of Walbeck (Germany)

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Conifers were major constituents of most vegetation types in the Mesozoic. Even when angiosperms played a key role in Earth's vegetation they have partly kept their evolutionary potential. After a certain decrease in diversity during the Early to Late Cretaceous (i. e. decrease/disappearance of Cheirolepidiaceae, Araucariaceae, Lindleycladus and allies) a mid-Cretaceous radiation has led to a renewal among this clade of seed plants. Several modern genera have been recorded for the first time, i. e. most of the genera of the Cupressaceae s. l., and new families seem to have been evolved from Early Cretaceous ancestors (Geinitziaceae, Doliostrobaceae).

In Europe the Maastrichtian is an interesting period for conifer diversity as „old" elements such as *Araucaria* and cheirolepidioid taxa still exist whereas modern cupressoid, taxodioid and pinoid taxa are already present. Among Maastrichtian floras from Europe the Walbeck flora seems to be the most diverse one containing more than 450 palynological morpho-species (sensu Krutzsch) and 67 carpological morpho-species that have been published by Knobloch and Mai. Preliminary results from investigations of the coniferous part of the flora presented herein document again a considerable number of genera and species.

The coniferous plant remains studied come from the Wechselfolge Member of the Walbeck Formation which is considered to be late Early Maastrichtian in age based on palynodata (Oebisfeld assemblage sensu Krutzsch). The Wechselfolge Member is interpreted as predominately lacustrine-fluvial deposits of meandering rivers in a costal plain partly interconnected with marine deposits originated from short-term ingressions. Palaeosoils including roots and wood bearing beds have been also detected. The conifer remains were part of the carpoflora that was washed out of sandy and silty sediment samples that have been collected by the co-author in 1970 in the sand pit Walbeck (Sachsen-Anhalt, central Germany). The coalified material (seed cones, seeds, foliage, pollen cones) is fragmentarily preserved but only slightly or non diagenetically plattened. Cuticles can be easily obtained by using Schultze solution and studied under LM and SEM.

Only seeds of *Taxodium hercynicum* Knobloch et Mai and foliage of *Quasisequoia* sp. sensu Kunzmann were mentioned from this material in previous publications. Therefore monographic investigation has been started. At the moment 8-9 taxa of the Cupressaceae (including former Taxodiaceae), 1 taxon of the Doliostrobaceae, and 1 taxon of Pinaceae are determined representing extinct and extant genera. Most of the conifers were common constituents of the subsequent Palaeogene vegetation in the central European coastal plains, mostly in azonal vegetation types such as swamps and riparian forests, but also in zonal vegetation types such as Evergreen Broadleaved Forests (i. e. conifer-Fagaceae-Lauraceae community).

Symposium E – Vortrag/oral presentation

How did the Cycads evolve in Central Europe during the Triassic?

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Probably for the first time appearing in Europe during the Permian (e.g., Bletterbach), the Cycads seem to be more diverse after the Permian-Triassic boundary. There are no actual records during the Lower Triassic apart from pollen. Even the famous Grès à Voltzia contains only some few plant remains that may very putatively be attributed to this group (e.g. *Zamites vogesiacus*). The first appearance of „large" and well developed cycad leaves and fructifications in the Triassic record of Europe happens with the Pelsonian (upper Anisian, Lower Middle Triassic) of Kühwiesenkopf /Monte Prà della Vacca (Italy) where already at least 4 different genera can be distinguished (*Taeniopteris*, *Bjuvia*, „*Nilssonia*" and the sporophyll *Dioonitocarpidium*). These well developed plant remains show clearly, that the previously missing record is more due to taphonomic and preservation reasons than because of the absence of this plant group in the vegetation, at least for the Alpine area. With the Ladinian (upper Middle Triassic) the cycads get more and more common, both in the Alpine area and in the German Basin (*Apoldia*, *Nilssonia*, *Bjuvia*, *Taeniopteris, Dioonitocarpidium*). With the appearance of the Bennettitales during the Carnian, the cycads do not increase much in variability anymore; even the famous Lunz flora shows only two different genera (*Nilssonia, Pseudoctenis*), although with different species than before. The coeval Raibl (Cave del Predil, Italy) flora is even more rarefied in cycads (*Apoldia*, ?*Bjuvia*) while the Neuewelt (CH) flora did not yield any cycads so far. The Norian-Rhaetian floras of the Alpine area are essentially devoid of plant remains, while in the German basin Cycads have been recorded only occasionally from the Norian (e.g., *Taeniopters*, some seeds and possible stems), and get more common again in the Rhaetian (e.g., various *Taeniopteris, Nilssonia* and *Pseudoctenis* species), before they get much more diverse in the Lower Jurassic.

Freie Themen – Poster

Paläontologie in der deutschsprachigen Wikipedia

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In der deutschsprachigen Wikipedia sind Mitte des Jahres 2010 paläontologische Themen in einem Umfang von etwa 1600 Einträgen verankert. Hinzu kommen viele Artikel zu rezenten Taxa, die in einem ihrer Kapitel auf die Stammesgeschichte und den Fossilbeleg eingehen. Auffällig ist besonders die inhaltliche Unausgewogenheit: Während sich über 500 Artikel den Dinosauriern, ca. 300 Artikel weiteren ausgestorbenen Wirbeltieren und etwa 200 Einträge dem Themenfeld Paläoanthropologie widmen, sind fossile Wirbellose (ca. 100 Einträge), fossile Pflanzen (<70) sowie die Themenfelder Mikropaläontologie (18) und Palichnologie (13) nur in geringem Umfang abgedeckt. Hierin spiegeln sich die Popularität der Wirbeltierpaläontologie und die Interessenlagen der wenigen bisherigen Autoren wider, die sich oft aus Vertretern anderer Zweige der Biologie und Geologie, aus der Studentenschaft und der Gruppe der interessierten Laien rekrutieren. Dass Hobbypaläontologen mit regionalgeologischem Hintergrundwissen in der Wikipedia kaum als Autoren aktiv sind, bedingt das Fehlen vieler Mitteleuropa-typischer Fossiliengruppen. Ebenso spärlich sind Informationen zu zentralen Konzepten der Paläontologie, etwa in den Bereichen, Biofaziesanalyse, Phylogenetik, Aktuopaläontologie, „Isotopenpaläontologie", Sklero- und Skeletochronologie, Molekulare Paläobiologie, 3D-Modellierung und biomechanische Modellierung.

Da wir Wikipedia als eine Chance der Gemeinschaft aller Paläontologen sehen, die wichtigsten Erkenntnisse und Themen ihres Fachgebiets sowie aktuelle Forschungsergebnisse medial unverzerrt einem breitem Publikum bekannt zu machen, rufen wir all diejenigen, denen Paläontologie am Herzen liegt, dazu auf, mit ihrem paläontologischem Fachwissen zur Wikipedia beitragen, sei es in Form kleiner Korrekturen oder umfangreicherer Artikel-Neuanlagen. Leider besteht unter Wissenschaftlern oft ein Wikipedia-Image, das von studentischen Plagiaten und der vermeintlichen Unzuverlässigkeit der Wikipedia-Inhalte geprägt ist. Tatsächlich haben sich in der Wikipedia-Community in den letzten Jahren qualitative Mindeststandards, Nachweispflicht, Mechanismen der Qualitätskontrolle sowie Review und Auszeichnung fachlich hervorragender Artikel durchgesetzt, so dass sich für Lehrer, Studenten und fachfremde Wissenschaftler das Potenzial, Wikipedia als Ausgangspunkt für Recherchen zu nutzen, erheblich gesteigert hat. Von unserem Aufruf sollen sich besonders auch Studenten und Paläontonlogen des akademischen Mittelbaus angesprochen fühlen, die ihre Fähigkeit zum wissenschaftlichen und laienverständlichen Schreiben im Rahmen von Wikipedia-Artikeln enorm verbessern können. Falls Wikipedia-Arbeit in die universitäre Lehre der Geo- und Biowissenschaften in Wahlmodulen zur Öffentlichkeitsarbeit oder Fachdidaktik eingebunden würde, könnte das Engagement für

die Vermittlung paläontologischen Wissens im Rahmen des Studiums vergolten werden. Grundlagen und Einstiegshilfen zur Wikipedia vermittelt das Autorenteam gern.

Freie Themen – Vortrag/oral presentation

Jaw Morphology in the Lower Cretaceous Hybodont Shark Tribodus limae

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The visceral skeleton (including a complete mandibular and hyoid arch and branchial arches) and teeth of the Lower Cretaceous (Aptian/Albian) hybodont shark *Tribodus limae* is described from well-preserved fossil material, and its jaw suspension and musculature are reconstructed (representing the first reconstruction of jaw musculature in a hybodont shark). The jaw suspension of *Tribodus* is similar to batoids and advanced galeomorphs in lacking direct cranio-palatine articulations and having skeletal jaw support by the hyoid arch alone (unlike most other hybodonts), but differs from batoids in that the hyoid arch is intact. The jaws are short anteriorly, as in the hybodonts *Asteracanthus* and *Lonchidion*, and were connected symphysially but not fused. CT scanning reveals the presence of supportive endochondral struts in force-bearing regions of the jaws, representing the first report of these structures in a fossil elasmobranch. Five branchial arches were present, of which pharyngobranchial, epibranchial, and ceratobranchial elements were observed (although hypobranchials and basibranchials were presumably also present). A pharyngobranchial blade is present as in some other hybodonts (e.g., *Lissodus*) and extant galeomorphs (e.g., *Heterodontus*), and the posteriormost pharyngobranchials are unfused. *Tribodus* had a durophagous diet, inferred from presence of endochondral struts and a weakly heterodont monognathic pavement dentition of flattened hexagonal teeth, as in extant myliobatoid rays. SEM examination shows that teeth of *Tribodus* are anaulacorhize with a double layer of single crystallite enameloid (SCE), and confirms the presence of columnar osteodentine, supporting the previous placement of *Tribodus* as the sister group to *Asteracanthus*.

Symposium H – Vortrag/oral presentation

What can the sponge genome tell us about the metazoan last common ancestor?

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Through the analysis and comparison of early branching animal lineages, the events leading to the origin and early evolution of the animal kingdom can be understood. As the oldest extant metazoans, sponges can enlighten us on the nature of the first animals and the transition to multicellularity. We have recently analysed the genome of the demosponge *Amphimedon queenslandica* from an evolutionary perspective, with a view to reconstructing the first evolutionary steps that led to the first animals. Through comparison with genomes from other ancient metazoan branches, we have attempted to map a chronology of genetic innovations in early animals, particularly focusing on developmental novelties. More than adult morphology, development reconciles sponges with the rest of the animal kingdom. It is hence not too surprising to see that many developmental genes are present in *Amphimedon* and thus likely arose with the first metazoans. We have analysed the striking amount that *Amphimedon* and other metazoans have in common – e.g. many neural and muscle developmental transcription factors, all major developmental signaling pathways, most components of epithelium formation and innate immunity. We have also catalogued what Amphimedon is missing, which indicates a gradual enrichment of the developmental program and body plans in early metazoans. Hence, molecular data is providing independent support for what morphology tells us – that sponges are not so different from other metazoans, but rather form part of a continuum of increasing complexity in the first branches of the metazoan tree.

Symposium I – Keynote

Peering into the crystalline eyes of trilobites

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Phacopid trilobites saw the Palaeozoic oceans through eyes containing calcite lenses. These ancient but highly sophisticated „schizochroal" eyes have fascinated palaeontologists ever since Ewan Clarkson and Ricardo Levi-Setti suggested that each lens had a doublet structure so that it focused light in a similar way to lenses developed in the 17th century by Des Cartes and Huygens. Although long heralded as a triumph of biological design, this elegant explanation has recently been challenged; alternative models include focusing of light using a graded density of organic inclusions (the GRIN model; Bruton & Haas 2003), or directing light to banks of photoreceptors using bundles of subgrains acting like optical fibres (Schoenemann & Clarkson 2008). Any resolution of this debate requires an understanding of the composition and microstructure of these lenses *in vivo*, which is challenging owing to the potentially obscuring effects of post mortem alteration. Using a range of high-resolution electron imaging and analysis techniques we have attempted to 'see through' the diagenetic overprint to reveal the original internal structure and composition of these lenses.

Of the twenty species examined nearly all have lenses that are richer in magnesium than the enclosing exoskeleton, and this magnesium is concentrated in dolomite crystals. The dolomite formed by early diagenetic recrystallization of magnesium calcite, thus demonstrating that the Phacopids simultaneously crystallized calcite exoskeletons and magnesium calcite lenses. The crystallization of magnesium calcite is surprising owing the low Mg/Ca ratio of the Ordovician to Devonian 'calcite seas' within which these animals lived, and such specialisation of biomineral compositions suggests that magnesium was critical for lens function. As the magnesium calcite imposes an inbuilt susceptibility to diagenetic alteration, it may be expected that primary lens microstructures would have been lost, but in fact original crystallographic orientations were preserved by secondary calcite owing to the very fine scale of the replacement reactions. All lenses contain calcite subgrains, and just beneath the curved outer surface of the lens they are arranged into a three-dimensional mesh of curved fibres, presumably to direct light to the lens centre and then photoreceptors beneath. These „radial fringes" have an exceptionally intricate geometry that was constructed by 'bending' crystals as they grew. It is difficult to envisage how such microstructures could have formed, especially given the need to rapidly develop eyes after moulting. Surprisingly terrestrial earthworms provide a good analogy as they can form granules of calcite of similar size and microstructure to the lenses, and all in less than one day.

Results of this work have enabled us to confidently reconstruct the *in vivo* chemical composition and microstructure of the lenses of schizochroal trilobite eyes. We are now completing optically modelling to elucidate how light moved through the calcite and was directed to the photoreceptors, so that we can understand better the palaeobiology and palaeoecology of these fascinating animals.

Bruton, D. L. & Haas, W. (2003): The puzzling eye of *Phacops*. – Special Papers in Palaeontology, 70: 349–361.

Schoenemann, B. & Clarkson, E. N. K. (2008): Did the trabecula in Phacopid lenses act as light guides? – Proceedings of the fourth international trilobite conference, Toledo, 4: 351–354.

Symposium K – Vortrag/oral presentation

Is the Ordovician explosion in the diversity of life related to climate cooling and glacial intervals?

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For several decades, the Early Palaeozoic was regarded as a long-lasting greenhouse period with stable climate conditions, and exept for the „Cambrian Explosion" there was nothing particularly spectacular with respect to the evolution of life. However, there is an extreme increase in diversity, especially during the Middle Ordovician, which was documented in detail over the last couple of years and already well visible in the classic Sepkoski curves. Since the „Webby Book" on Ordovician biodiversity was published in 2004, discussions focused on Ordovician radiations and their triggers. The Ordovician System spans about 70 million years and - as discussed in the frame of this Symposium by Thomas Servais et al. - is the geological period when the real exlosion of life occurs, termed the GOBE or Great Ordovician Biodiversification Event. Major radiations and the establishment of complex ecosystems were triggered by long-lasting physico-chemical and biological processes such as changes in palaeogeography, intensity of volcanism, climate and trophic networks.

$\delta^{18}O$ data from biogenic (conodont) apatite provide the reliable tool to infer temperature changes. There is a clear cooling trend throughout the Ordovician. Together with facies data from different palaeocontinents, the $\delta^{18}O$ record suggests the existance of at least two glaciations prior to the famous Hirnantian Glacial. There is evidence for a short-lived glacial already in the uppermost Sandbian, and for a second glaciation in the middle Katian. The peaks in Ordovician biodiversity in the curves of Sepkoski, the curves of specific faunas published in Webby et al. (2004), together with the appearance of highly complex reef systems coincide with the late Middle though Late Ordovician cold periods or glacials. Diversity peaks seem to coincide with the cold intervals and drops in diversity with intermittent warmer periods during early Palaeozoic times. It is plausible that changes in climate played an important role in early Palaeozoic extinctions and radiations and highly influenced macro-evolution.

Symposium K – Vortrag/oral presentation

Yellowstone-like microbial environments in Tremadocian hydrothermal vent systems at the northern Gondwana margin (Prague Basin, Czech Republic)

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Since the first discovery of hydrothermal vent communities about 40 years ago, many papers compiled the record of oxide precipitation by bacteria at vent sites in different marine environments. The Bohemian vents, which developed in terrestrial and marginal marine continental settings are strikingly different from the locations with classical hydrothermal vent communities in deep marine environments at mid-ocean ridges, sea-mounts and in back arc basins. In contrast to these high temperature hydrothermal vent systems, fluid inclusions from the Bohemian early Ordovician vent sites relate to temperatures between 80 to 160°C and compare well with the environmental conditions of modern hydrothermal systems in different terrestrial volcanic environments.

During the early evolution of the Prague Basin, a system of hydrothermal vents formed along WSW-ENE striking major fault zones. Enigmatic bacterial communities flourished in certain areas of this hydrothermal field and led to the formation of morphologically highly variable silicified Fe-stromatolites. Some „microstromatolites" are similar to Proterozoic structures and rare in the Phanerozoic record. Other morphologies remind of typical Archaean through Cambrian forms. Volcanic centres were very active in the eastern basin during the early Ordovician. Many stromatolite sites may have been developed in hot pools in a Yellowstone-like volcanic landscape, of course lacking any vegetation. Some vents formed along fault zones in a marginal to very shallow-marine setting where stromatolites settled on top of coarse grained conglomerates. Low-diversity microbial communities (different types of filamenteous and coccoid bacteria) are the only organisms adapted to these strongly volcanically influenced environments. All iron precipitation seems to be triggered by microbial activity and bond to organic matter. The formation of the Bohemian Fe-stromatolites represents the oldest record of intracontinental hydrothemal vent communities.

Symposium K – Poster

Ecological and behavioural changes associated with the evolution of tagmosis in scutelluid trilobites

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As a defence strategy, enrolment has likely played a major role in the evolutionary success of trilobites, but it has also strongly constrained the organization of their body. This latter has thus remained virtually unchanged during the 275 million years of trilobite history, except in few clades, such as scutelluids. In the latter, the pygidium was not simply a set of unarticulated trunk segments, but an extended structure with notable morphological particularities representing a distinct posterior tagma. Morpho-functional analyses reveal that this unique morphological evolution was accompanied by major ecological changes. Most scutelluids were likely epibenthic organisms benefiting from their flat body and extreme thoracic flexibility to hide in crevices or superficially burrowed depending on the substrate. Like most trilobites, they could crawl on the sea floor but in addition they were probably able to swim, their body turned upside-down. Microstructural studies of the hypostome suggest that many scutelluids were provided with rudimentary ventral eyes, the function of which was essential while swimming. Enrolment was rare and incomplete - it had probably been supplanted as the main defensive strategy by rapid escape involving the large paddle-like tail. Another ecological type within scutelluids is exemplified by the Paralejurinae. These latter have apparently developed, though secondarily, a strongly vaulted body recalling scutelluid ancestral morphology. This and other morphological traits point towards a largely endobenthic life style. It can also be demonstrated that, unlike typical scutelluids, paralejurines were able of complete enrolment, the efficiency of which was sometimes improved by coaptative devices.

Symposium K – Vortrag/oral presentation

Inferring internal anatomy from the trilobite exoskeleton: the relationship between frontal auxiliary impressions and the digestive system

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The digestive system of trilobites is rarely preserved. As a result, many aspects of its organization remain unknown. Fortunately, the exoskeleton sometimes preserves evidence of soft-tissue attachment sites that can be used to infer internal anatomy. Among them are the frontal auxiliary impressions (FAIs), probable soft-tissue insertion sites located on the

frontomedian glabellar lobe of some trilobites.

FAIs are herein described in the Carboniferous trilobite *Phillipsia belgica* Osmólska, 1970 - representing the only known example of such structures in the Proetida and their youngest occurrence. A taphonomic scenario is proposed to explain their variable preservation. Although particularly common in the Phacopina, FAIs or FAI-like structures are also found in several orders that differ greatly. Comparisons with modern analogues suggest that FAIs might represent attachment sites for extrinsic muscles associated with a differentiated crop within the foregut.

A review of purported remains of the trilobite digestive system indicates that it usually consisted of a tube-like tract flanked by a variable number of metamerically paired diverticulae. Its anterior portion is not particularly individualized, except in a few specimens that might hint at the presence of a crop. This differentiation of a crop might have constituted a secondarily evolution of the foregut in trilobites, occurring independently in different clades. Accompanied by a strengthening of associated extrinsic muscles, this modification of the foregut might explain the presence of more conspicuous muscle insertion sites on the glabella. Study of FAIs might therefore provide new data on the anatomy of the foregut in trilobites and evidence of diverse feeding habits.

Symposium K – Poster

The Cephalic Median Organ of trilobites: an enigmatic arthropod cuticular structure

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Like that of most modern arthropods, the cuticle of trilobites exhibits numerous enigmatic structures, the functions of which remain almost completely unknown. This is particularly true for the cephalic median organ (CMO), a small complex of structures present on the cephalon of some trilobites, usually on their occipital ring. Typically composed of four pits arranged like the corners of a square, it is common in odontopleurids and corynexochids. Our investigations on the CMO reveal that in fact it occurs in all but one order of trilobites. The earliest record is in the Middle Cambrian, where it is found in three orders. Its existence can be documented until the Late Carboniferous. The CMO appears extremely conservative in terms of organization, morphology, and position despite a great variability of CMO-bearing trilobites. This suggests a particularly early origin for this organ and that it was an essential structure in trilobites.

The CMO strikingly resembles a group of crustacean sensory organs, especially the Sensory Dorsal Organ (SDO) of malacostracans. This raises the question of the kind of relationships (analogy/homology?) existing between them. The SDO is known to be widely distributed within the Malacostraca but its function is still debated, which makes it difficult to ascertain whether the CMO functioned in a similar way. However, the variability and distribution of these two organs already provide critical arguments concerning their possible function(s) and relationships. These suggest that a unique origin of these two organs is credible, which has profound affects on reconstructions of phylogenetic relationships between major arthropod clades.

Symposium C – Poster

A working systematic for Mid Jurassic - Cretaceous corals

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The stony corals (order Scleractinia, Mesozoic-Extant) are rich in families, genera and species. They lived and live in shallow marine environments and are sensitive to climate change. At several critical faunal turnovers (Late Triassic, Late Liassic, Valanginian/Hauterivian boundary, Cenomanian/Turonian boundary, Cretaceous/Tertiary boundary) many genera became extinct and new ones originated resulting in a high number of total genera. Faunas of the intervals Middle-Late Triassic, Liassic, Doggerian-Valanginian, Hauterivian-Cenomanian, Turonian-Maastrichtian and Cenozoic differ greatly in their generic composition.

No model currently exists for the classification and/or evolution of the entire order Scleractinia, but there are schemes focussing on either Triassic to Early Jurassic, Jurassic to Early Cretaceous, or Cenozoic corals. However, it is a difficult task to link these concepts as they differ remarkably because corals of the various periods are very different.

The present design is restricted to Middle Jurassic to Late Cretaceous corals. It is not an evolutionary scheme, but a working systematic with which it should be possible to classify fossil coral material. In contrast with other concepts, it pays greater attention to the corals of the Late Cretaceous. Moreover, the new concept is strictly based on type material.

The graphic scheme presented in the poster shows that a traditional „tree design“ for Scleractinian corals is not possible: certain striking features (the existence of a main septum, of lonsdaleoid septa, a marginarium, auriculae, the presence of septa of the first septal generation being much thicker than the others) are found in various families traditionally assigned to different suborders.

The subdivision into suborders and families is mainly based on the microscopic structure of the septal blades: size of the calicular centres, porosity of the septa, and ornamentation of septal faces and upper margins. Here, 12 suborders and 40 families are distinguished. Some suborders were not subdivided into families (Archeocaeniina, Caryophylliina) because of the absence of type material or its rarity in the time span considered. Some traditionally used family names were not applied because the corresponding type material was not available, poorly preserved or contradicts the concept of the family (Dendrogyridae, Latomeandridae, Meandrinidae, Smilotrochidae). Some families (Actinacididae, Agatheliidae,

Hemiporitidae, Poritidae) were transferred to other suborders, while some suborders (Amphiastreina, Heterocoeniina, Meandrinina) were further subdivided into families or informal groups of genera.

Symposium B – Vortrag/oral presentation

Diversity changes in Nerineid gastropods

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Nerineid gastropods colonised very shallow marine habitats during the Jurassic and Cretaceous. They are well known and can be easily distinguished from other gastropods by their complicated system of internal foldings that developed inside their whorls to cope with strong currents. In order to compare changes in their diversity to those of other shallow marine organism groups (such as corals or rudist bivalves) a PaleoTax database was constructed (www.paleotax.de) with data taken entirely from the literature. No changes were made (on species synonymy or the assignment of species to genera), except for the stratigraphy of locality, which was improved where possible.

This presentation gives preliminary results. The family Nerineidae currently has ca. 30 genera and ca. 1000 species (of which 12% are considered synonyms). The number of endemic species is very high. The ranges of species are short (on average 6.8 Ma), while those of genera are comparably longer (43 Ma).

During its existence, this family experienced various diversity changes. The earliest Nerineids are known from the Latest Triassic. The number of genera remained low until a diversity peak in the Bathonian, followed by a drop in the Callovian and another peak in the Late Jurassic. After the Jurassic/Cretaceous boundary, the number of genera dropped, probably due to a fall in sea level. New genera appeared within the Urgonian platform facies, but from OAE1b in the late Early Aptian on, generic diversity diminished stepwise towards the Maastrichtian. Species diversity is comparable to that of genera: a sudden rise in the Bathonian, a crisis during the Callovian, a very high number of species from the Late Oxfordian to the Tithonian, a 75% drop at the J/K boundary, a slight recovery during the Valanginian to Barremian, a slight increase in the Boreal Cenomanian, and a strong reduction of taxa from the Coniacian on.

Distribution patterns are very difficult to trace due to the high number of endemic species. As a modern systematic revision of the family does not exist, it remains unclear whether this endemism is real, or is caused by the endemism of the various researchers.

Symposium J – Vortrag/oral presentation

The new old era in actinopterygian research

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Shaken by two of the biggest catastrophic events on Earth around the Permo–Triassic and the Triassic–Jurassic boundaries, the early Mesozoic history of actinopterygian fishes is as fascinating as complex. As happened with the other vertebrate groups, the actinopterygians went through significant faunal turnovers that led to the establishment of our teleost-dominated modern fish faunas. At the Permo-Triassic boundary, the late Palaeozoic faunas, dominated by cheirolepidiforms, elonichthyforms, amblypterids and palaeonisciforms, were replaced by the faunas of „subholosteans" and neopterygians. These fishes rapidly diversified during the Triassic and, although the „subolosteans" almost disappeared at the end of the Triassic, the neopterygians went on diversifying and become dominant. The composition of the neopterygian faunas during the Triassic and Jurassic shows a complex pattern of diversification of several basal neopterygians, diversification and decline of several lineages of „subholosteans" and basal teleosteomorphs, and the rise of true teleosts. Understanding this complex pattern of actinopterygian evolution during the Early Mesozoic has been hindered by the general acceptance of a monophyletic Halecostomi [Teleostei + Halecomorphi] preceded by a unidirectional comb-pattern evolution ordering the supposedly transitional forms collectively referred to as „subholosteans" and several of the apparently more primitive „holosteans". Interestingly, though, recent molecular and morphological studies have shown a monophyletic group including Lepisosteids, Amiids and their closest relatives, which corresponds to Huxley's Holostei of 1861. This renewed old hypothesis together with the advances in the knowledge of very interesting fossils, mainly from Triassic lagerstätte, come together to break with the paradigm of the Halecostomi and open a new era in the palaeoichthyological research. I present here a summary of these new discoveries and perspectives in actinopterygian systematics and the reasons for which the currently poorly matching tiles in the actinopterygian puzzle should be taken apart to start puzzling again and corroborate either the Halecostomi or the Holostei, and, furthermore, a probably monophyletic Subholostei.

Symposium J – Poster

New semionotiform from Ettling (Late Jurassic of southern Germany)

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Among the fossil lagerstätte representing the Late Jurassic Solnhofen Archipelago in the Franconian Alb in southern Germany, Ettling stands out because of its extremely well preserved fossil fishes. Although only few of the identified taxa have been studied so far, Ettling has already provided a rich fish fauna with an amiid, an ionoscopid, an ophiopsid, *Furo*, macrosemiids, pycnodontiforms, aspidorhynchids, and several teleosts including ichthyodectiforms, and the orthogonikleithrids *Orthogonikleithrus* and *Leptolepides*. Here we present a new semionotiform genus characterized by a unique combination of primitive and derived characters and one autapomorphy: the presence of an additional row of 6 scales aligned with the 3 paired ventral caudal basal fulcra and the following five caudal fin rays. At first glance, the fish approaches the macrosemiids in overall similarity and, although it lacks the sinapomorphies of that group, a first cladistic analysis shows its sister-group relationship with the Macrosemiidae. This sister-group relationship is supported by one uniquely derived feature: the presence of a single paired of extrascapular bones, which do not reach the midline and are placed lateral to the parietal bones. Furthermore, this relationship is also supported by two homoplasies: a high number of anterior infraorbital bones and a relatively small interoperculum.

Symposium J – Poster

New controversial neopterygian from the Triassic of Monte San Giorgio

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A new basal neopterygian, very abundant in the Besano Formation (Latest Anisian-Earliest Ladinian) and Meride Limestone (Early-Late Ladinian) of the Monte San Giorgio, which has been wrongly referred to *Archaeosemionotus* Deecke 1889, is currently being thoroughly studied for the first time based on the numerous specimens at the Paläontologisches Institut und Museum of the Zürich University and excellently preserved specimens recently recovered during the excavations started in 2006 by the Museo cantonale di storia naturale of Lugano in the Cassina beds (lower Meride Limestone). The fish represents a new taxon and has shown a complex morphology with a mixture of amiiform and semionotiform features. Among these controversial features, the pattern of bones in the roof of the skull, with a pair of large nasals sutured at the midline and suturing a thin, nearly V-shaped median rostral anteriorly, is the typical condition in amiiforms. On the other hand, the presence of anterior infraorbital bones and a large quadratojugal taking part in the single lower jaw articulation are typical of semionotiforms. Therefore, the fish cannot be assigned to one or the other fish groups.

The close phylogenetic relationship between *Amia* and *Lepisosteus* and, thus, between amiiforms and semionotiforms in a monophyletic Holostei has been proposed in several phylogenetic analyses of molecular and morphological data. Within this context, the new taxon might represent a basal holostean and its peculiar morphology throws light on the evolution of several characters that have been proposed as synapomorphies at different levels within the Halecomorphi. The new neopterygian taxon is thus very important to explore the monophyly of the Holostei and the phylogenetic relationships within this major group.

Symposium F – Poster

Drift in Miocene mammalian biodiversity hotspots along a latitudinal gradient

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In 2005, the question ‚What determines species diversity?‘ was selected as one of the 25 most important fundamental but unanswered questions in science. For paleontologists the challenge is now to reconstruct biodiversity patterns of the past. Historical data can show how hotspots came to be, and, more importantly in these days of crisis, how they came to their demise. The difficulty lies in that no single locality gives a complete overview of the biodiversity in a particular period. On the generic level, we have combined data from mammal localities within squares of 2x2 degrees, and plotted the number of taxa per square. This has been done for localities in Europe and Asia Minor up to 40°E longitude, one of the most intensively studied areas in mammal palaeontology. The procedure was followed for each mammal zone in the Miocene and beginning of the Pliocene. The maps clearly testify of the patchiness of the fossil record. However, when comparing the data from different zones, there is initially a distinct trend of a southward movement of the hotspots. This leads to a climax in MN 9 in the area around Barcelona. This remarkable hotspot in diversity is followed by a period in which the diversity is more evenly distributed. Making separate analyses for small and large mammals shows that the pattern is much better observable in rodents and insectivores than in the ungulates and carnivores. Presumably, this is due to the higher completeness of the fossil record of micromammals.

Symposium J – Vortrag/oral presentation

Jurassic mammalian diversity in Central Asia

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The Late Middle Jurassic (Callovian) Balabansai Formation in the northern Fergana Valley in Kyrzgyzstan has yielded the most diverse Jurassic mammal assemblage of Asia. At least ten mammal taxa have been identified on the basis of mostly isolated and fragmentary teeth: Docodontans cf. *Simpsonodon* spp., *Paritatodon* sp., *Tashkumyrodon desideratus*, Tegotheriidae indet., and Docodonta indet., eutriconodontans Amphilestidae indet., *Ferganodon narynensis*, cf. *Ferganodon* sp., and Triconodontidae indet., „symmetrodontan" Tinodontidae indet. and cladotherians Paurodontidae indet. and Amphitheriidae indet. The occurrences of Triconodontidae, Tinodontidae, and Paurodontidae in the Balabansi Formation represent the oldest-known records of these groups. The Balabansai mammal assemblage is basically similar to the Bathonian mammals of the Forest Marble in England and the Itat mammal assemblage in Siberia respectively, revealing at present knowledge a marked uniformity of the Middle Jurassic mammal fauna across Laurasia. The assemblages also indicate the advent of a more derived, Late Jurassic mammalian community, with first dryolestids in the Forest Marble and first triconodontids, tinodontids, and paurodontids in the Balabansai Formation.

Five mammalian taxa based on teeth and jaw fragments are reported from a bonebed of the Late Jurassic (Oxfordian) Qigu Formation at the Liuhuanggou site in the southern Junggar basin. The mammals recovered so far comprise a new eleutherodontid haramiyid, the docodonts *Dsungarodon* and *Tegotherium*, an undetermined amphilestid triconodont, and a new species of the stem zatherian *Nanolestes*. Currently this represents the most diverse Late Jurassic mammal assemblage of Asia. The Liuhuanggou mammal assemblage is dominated by docodonts. *Tegotherium* has been formerly reported from the Late Jurassic Shar Teeg locality in Mongolia. Except for the common occurrence of *Nanolestes,* the mammal assemblage of the western European Late Jurassic Guimarota coal (Portugal) is quite different. The Guimarota assemblage is dominated by five genera of dryolestidans and several genera of multituberculates, which have not been reported from the Qigu assemblage. The known Late Jurassic mammal assemblages of Asia are similar to the Middle Jurassic assemblages known from Asia and western Europe (Kirtlington).

The Early Cretaceous mammal assemblages of Asia are dominated by multituberculates, gobiconodontid eutriconodontans, symmetrodontans, and eutherians. The earlier Late Jurassic mammal assemblages of Asia, including the Qigu assemblage, are essentially Middle Jurassic in composition. The faunal turnover, leading to the mammalian communities characteristic of the Early Cretaceous, probably occurred in Asia sometime after the Oxfordian, possibly during the Kimmeridgian.

Symposium E – Vortrag/oral presentation

The gymnosperm component of early Cretaceous palaeoequatorial environments, as seen in the Crato flora of northeastern Brazil

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The Aptian palaeovegetation of the Crato Formation (northeastern Brazil) is of high diversity with more than 80 taxa. Among these the gymnosperm component makes up about two thirds of all taxa. Various gymnosperm groups are present: seed ferns, Bennettitaleans, conifers and gnetophytes are the most diverse components. Various conifers have been described from several cones and sterile branches. These remains belong to Araucarians and to several genera of Cheirolepidiaceae, a family that is also well represented by pollen. Palaeobiogeographically these conifers belong to cosmopolitan genera (*Frenelopsis*, *Araucaria*), to genera endemic to South America (*Tomaxellia*), and to typical Northern hemisphere genera (*Lindleycladus*) indicating that this part of Northern Gondwana was still connected to other continents via plant migration routes. The Crato flora contains also several taxa of hitherto unknown gymnosperms of which a certain part may be connected to the gnetophytes. The latter group is remarkably well represented and much more diverse than at other localities of the northern Gondwanan realm. Overall the diversity may surpass twenty taxa and include ephedroid, welwitschioid and gnetoid genera, some of them closely related sister taxa to extant gnetophyte genera. The extraordinary diversity of the gnetophyte component is best understood when we assume an early adaptation of this plant group to seasonally dry conditions and their growth in habitats/ecological niches to which early angiosperms had not adapted yet at this time period.

Interestingly, other groups commonly known from other Gondwanan continents are not recorded from the Araripe Basin (Ginkgophytes with Karkeniaceae, Pentoxylales). Nevertheless the Crato flora is an important place for studying evolution and diversity of Cretaceous seed plants and has a potential for discovery of hitherto unknown groups of gymnosperms.

Symposium A – Vortrag/oral presentation

Lycopsids from the Triassic Madygen Lagerstätte (SW Kyrgyzstan, Central Asia)

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During the Late Carboniferous the lycopsids reached their greatest diversity and morphological disparity, which included the giant arborescent Lepidodendrales. After the end-Permian biotic crisis, lycopsids were dominant elements in the Early Triassic worldwide. It is generally assumed that since the Middle Triassic diversity and abundance of this group has declined until today. However, the Middle to Late Triassic Madygen Formation (SW Kyrgyzstan) contains rich and diverse assemblages of lycopsid fossils, including impressions and compressions of axes (*Ferganodendron*, *Lycopodites*), sterile leaves (*Mesenteriophyllum*, *Isoetites*), and sporophylls (*Annalepis*). Moreover, although no organic remains are preserved in this material, specimens of *Annalepis* and *Mesenteriophyllum* are preserved in a very fine-grained sediment matrix, resulting in an exceptional preservation of the epidermal cell patterns. In order to examine epidermal features in these latter two taxa silicon replicas were made using vinylpolysiloxane, a high-quality impression material based on low-viscosity silicon conventionally used in dental laboratories. Silicon replicas were then sputter-coated with gold and analysed under SEM. Application of this method promises to contribute towards a more accurate characterization of the individual taxa and may be helpful for whole-plant-reconstructions.

Symposium F – Poster

Morphologische Besonderheiten von Theropoden-Fährten aus dem Mitteljura der Rep. Niger, Afrika

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An einer neue Fundstelle in der Ebene von Agadez (Rep. Niger, Nordwest-Afrika) aus dem Mittleren Jura, der so genannten Irhazer-Site, wurden exzellent erhaltene didactyle Fährten von zweibeinig laufenden, digitigraden Fährtenerzeugern gefunden. Es konnten fünf verschiedene Fährtenzüge mit insgesamt 120 Einzelabdrücken unterschieden werden (von A bis E bezeichnet), die alle von dem gleichen Typ eines bipeden Theropoden stammen. Fährtenzug A enthält 22, Fährtenzug B 26, Fährtenzug C 19, Fährtenzug D 23 und Fährtenzug E 9 aufeinander folgende Einzelabdrücke, anhand derer Messungen zur einfachen und doppelten Schrittlänge (pace- and stride length) und zu den Schrittwinkeln (pace angulation) möglich waren.

Die längeren Fährtenzüge A bis D, deren Trittsiegel alle gleichgroß sind, verlaufen in zwei Hauptrichtungen. Die Abstände zwischen den Trittsiegeln variieren deutlich. Eine durchschnittliche Schrittlänge von 117 cm und das Fehlen von Schleifspuren vor den Zehenabdrücken deuten auf ein langsames vorsichtiges Gehen des Fährtenerzeugers hin. Die Trittsiegel des Fährtenzuges E unterscheiden sich von den anderen durch kürzere Zehenabdrücke und einen höheren Spreizwinkel zwischen den Zehen III und IV. Nur die Trittsiegelbreite entspricht mit 23,4 cm exakt der aller anderen Abdrücke. Die Fährtenzüge A bis D erstrecken sich entlang eines schmalen langen Abschnitts von rund 1,5 m Breite und 40 m Länge. Durch eine Reihe von Übertritten kann eine zeitliche Abfolge der Fährtenentstehung nachgezeichnet werden. Die ältesten Fährten sind die Züge B und D, gefolgt von A und C in exakt die entgegengesetzte Richtung, die nur kurze Zeit später entstanden sind. Fährtenzug E, im rechten Winkel die anderen längeren Fährten kreuzend, entstand als letzter Fährtenzug. Die zugehörigen Abdrücke übertraten die Trittsiegel der anderen Fährtenzüge. Aufgrund der nahezu gleichen Größe der Trittsiegel von Fährtenzug A bis D und der gleichen guten Erhaltung ist es wahrscheinlich, dass die gleichen zwei Individuen, die Fährten B und D erzeugten, plötzlich umdrehten und den selben Weg wieder zurückgingen, ihre eigenen Abdrücke übertraten und schließlich die Fährtenzüge A und C hinterließen. An einer Stelle scheinen sich zwei Individuen sehr nahe gekommen zu sein, so dass einer von ihnen zur Seite ausgewichen ist, um nicht mit dem anderen zusammen zu stoßen. Wechselnde Laufgeschwindigkeiten der Fährtenerzeuger sichtbar anhand der wechselnden Schrittlängen, hingen vom Untergrund und abrupten Wechseln der Laufrichtung ab. Die Abschätzung der Laufgeschwindigkeiten anhand der Schrittlängen nach konventionellen Methoden ergab Werte von rund 13 km/h für die Züge A bis D und rund 6 km/h für Zug E.

Der gute Erhaltungszustand der vielen Trittsiegel offenbart viele Details zur Fußmorphologie der Fährtenerzeuger. Die Trittsiegel sind typisch für Theropoden mit nur zwei Gewicht tragenden Zehen (Zehe III und IV). Ein kleiner Ballenabdruck der Zehe II ist bei vielen Trittsiegeln überliefert. Abdrücke der Metatarsalia am hinteren Ende der Abdrücke sind bei keinem der Trittsiegel erhalten, obgleich sie sehr tief ins Sediment eingedrückt wurden, was auf eine digitigrade Körperhaltung des Tieres bei Laufen hindeutet. Alle beobachteten Fährtenmuster deuten darauf hin, dass das Erscheinungsbild der bipeden Fährtenerzeuger dem eines heutigen modernen Laufvogels sehr ähnlich gewesen sein muss.

„Auf der Mauer, auf der Lauer" – Die geodidaktische Aufarbeitung der Station 10 des Geopfades Stadt-Land-Fluss

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Am 18. Dezember 2008 fand die Eröffnung des Geopfades Stadt-Land-Fluss in Frankfurt am Main statt. Der Geopfad umfasst insgesamt 10 Stationen und zeigt geowissenschaftliche und geographische Sachverhalte in Frankfurt und Umgebung.

Im Rahmen einer Diplomarbeit am Institut für Geowissenschaften, Goethe-Universität Frankfurt wird die 10. Station „Fränkische Ammoniten in Frankfurt", bearbeitet. Die Station umfasst eine Natursteinmauer im Bonifatiuspark, die mangels Festgesteinaufschlüssen in die Route des Geopfades einbezogen wurde. Die recht imposante Natursteinmauer umfasst eine Höhe von bis zu 5 m und hat eine Fläche von 15 000 m².

Die Mauer besteht im Kern aus Stahlbeton, ist jedoch vollkommen von Naturwerksteinen bedeckt. Zum kleineren Teil besteht die Vorderfront aus chinesischen Sandstein, über dessen Ursprung leider keine nähere Informationen vorliegen. Der größte Anteil besteht aus Kalkstein, der unter dem Handelsnamen Treuchtlinger Marmor bekannt ist. Dieser ist aufgrund seines hohen erkennbaren Fossilgehaltes geodidaktisch verwertbar. So wurden für die Bearbeitung bis zu einer Höhe von ca. 2 m alle mit bloßen Auge erkennbaren Makrofossilen (Belemniten, Ammoniten, Pelecypoden und Gastropoden) im Treuchtlinger Marmor fotographisch erfasst und anschließend in ihrer Systematik zugeordnet.

Ziele der Bearbeitung sind die systematische Erfassung der Makrofossilien und deren geodidaktische Aufarbeitung.

Bisher sind die meisten Fossilienfunde bis auf Artebene bestimmt. Ihre weitere Verwendbarkeit für geodidaktische Arbeiten wurde ebenfalls vorgenommen. Die Betrachter der Mauer können sich im Wesentlichen nur mit dem Auffinden und Zuordnung der Fossilien beschäftigen.

Die geodidaktische Ausarbeitung erfolgte in einer Zusammenstellung einer Arbeitsmappe für Kinder im Alter zwischen 7 - 9 Jahren. Bisher liegt nur ein Prototyp dieser Arbeitsmappe (Stand Juli 2010) vor, die noch in weiterer Bearbeitung steht und voraussichtlich im Herbst 2010 veröffentlicht wird.

Genes, development, and fossil morphologies: an example from vertebrates

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Bringing together insights from molecular biology and fossils does not necessarily require DNA sequencing in the wetlab, as such integrative studies can also be performed without the experience in molecular techniques. This especially applies to the combination of (fossil) morphology with developmental genetics. Here we present a recent study on the evolution of vertebral numbers in amniote vertebrates, the clade comprising mammals, reptiles, and their fossil relatives. Studies from developmental genetics have shown that the regionalization of the amniote body axis is strongly determined by different Hox gene expressions, in addition to somitogenesis and somatic growth which also determine axial morphology. Because the ossified vertebrae, which are derived from embryonic somites, well reflect the underlying developmental mechanisms, sufficiently preserved fossils can be used for tracing ancient developmental history. Using a comprehensive data set of fossil and extant amniotes and their vertebral numbers we were able to show that a) somitogenesis and *Hox*-mediated regionalization are independent processes, b) mammals and early synapsids share the conserved axial configuration of crown mammals, whereas reptiles exhibit remarkable axial developmental plasticity, and c) similar selective pressures result in the same developmental innovations in both reptiles and synapsids. This example illustrates the potential of integrating paleontological studies with developmental genetics, and the approach presented here may well be used for other systems in the future.

Freie Themen – Poster

Sedimentologie & Paläoökologie des Niederplanitz-Horizonts (Unter-Rotliegend, Planitz-Formation) im westlichen Chemnitz-Becken

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Beim Bau der Autobahn-Querspange A4/A72 waren im Raum Zwickau-Stenn 2008/2009 Sedimente aus dem Unter-Rotliegend des Chemnitz-Beckens aufgeschlossen. Es konnte ein etwa 180 m mächtiges Profil, beginnend mit devonischem Grundgebirge, über die überwiegend fluviatil ausgebildete Härtensdorf-Formation und die vulkanoklastisch dominierte Planitz-Formation bis in die alluvial plain bis flood plain Sedimente der Leukersdorf-Formation aufgenommen werden.

Etwa 10 m über der Basis der Planitz-Formation ist der ca. 4 m mächtige, litho- und biostratigraphisch bedeutsame Niederplanitz-Horizont ausgebildet. Die Ton- bis Schluffsteine mit eingeschalteten Tuffstraten dieses lakustrinen Leithorizonts weisen eine diverse Flora und Fauna auf. Durchgeführt wurde eine detaillierte Litho- und Biofaziesanalyse des Seehorizonts, seiner Verlandungsfazies und des synsedimentären Vulkanismus anhand von 69 An- und 83 Dünnschliffen sowie 45 kg Proben und über 1100 Fossilbelegen. Die etwa 25 cm mächtige, dominierend tonig ausgebildete voll-lakustrine Fazies des Niederplanitz-Horizonts liegt lokal als Schwarzpelit vor, welcher sich lateral über ca. 5 m erstreckt, allerdings über eine Distanz von etwa 1-2 m fließend in eine rote Ausbildung übergeht. Wahrscheinlich lag dieser rote Tonstein primär ebenfalls als Schwarzpelit vor. Im Dünnschliff lässt sich eine absetzige Lamination beobachten, welche mit seismischen Schocks infolge des synsedimentären Vulkanismus erklärt wird. Sowohl im Aufschluss als auch in den Anschliffen ist diese vulkanische Tätigkeit anhand geringmächtiger Tufflagen bzw. synsedimentärer, meist cm- bis dm-mächtiger Auf- bzw. Abschiebungen nachweisbar. Die deutlich schluffigeren bis feinsandigen Feinklastite der etwa 3,75 m mächtigen Verlandungsfazies zeigen keine so deutliche Lamination, sind allerdings ebenfalls durch rotbraun-grauweiße Farbwechsel horizontal stratifiziert. Auch hier ist synsedimentäre, vulkanotektonische Aktivität in Form von cm-mächtigen Tufflagen und kleineren Auf- und Abschiebungen im cm- bis dm-Bereich erkennbar.

Als Invertebraten konnten auf wenigen Schichtflächen Lagen von Conchostraken in Schattenerhaltung dokumentiert werden, welche wahrscheinlich den im See lebenden Actinopterygiern als Nahrung dienten. Bei einzelnen Exemplaren sind Zuwachslinien erkennbar. Unter den Actinopterygiern dominiert die vermutlich planktivore Gattung *Paramblypterus*. Die meist rhombischen Schuppen weisen häufig gesägte Ränder auf. Die Zähne besitzen die typischen Schmelzkappen. Möglicherweise können einige Schuppen auch zu *Igornichthys*, einem insectivoren Räuber, gerechnet werden. Die Topräuber des Niederplanitz-Sees waren xenacanthide Haie, welche durch isolierte Zähne sowie Koprolithen nachgewiesen wurden. Anhand von REM-Aufnahmen konnten 45 der 50 näher analysierten Zähne eindeutig der Gattung *Bohemiacanthus* zugeordnet werden.

Lediglich ein Exemplar einer Konifere (?*Ernestiodendron*) konnte identifiziert werden. Unter den deutlich häufigeren Farnen dominieren hygro- bis mesophile Elemente, die vermutlich in unmittelbarer Nähe zum See wuchsen. Häufig sind *Oligocarpia* und *Scolecopteris/Pecopteris*. Deutlich seltener ist *Nemejcopteris*. Von den Pteridospermen konnten u. a. *Odontopteris/ Neurodontopteris* und die kletternde *Pseudomariopteris* dokumentiert werden. Der Großteil der Flora liegt als isolierte Fiederchen vor.

Symposium B – Vortrag/oral presentation

Ammonite biostratigraphy of the lower Upper Cretaceous (Cenomanian – Turonian) of the north Eastern Desert (Wadi Araba area, Egypt)

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The lower Upper Cretaceous successions of the Eastern Desert of Egypt are rich in macrofossils. Over the past twenty years, much progress has been made in Cenomanian – Turonian (Upper Cretaceous) ammonite biostratigraphy of the area (e.g. Luger & Gröschke 1989; Hewaidy et al. 2003). However, many studies were largely based on limited ammonite material with poor to moderate preservation at best, predominantly collected close to the western bank of the Gulf of Suez in the Eastern Desert. This is somehow surprising as the western part of the Eastern Desert in Wadi Araba has both, good exposures of lower Upper Cretaceous strata and abundant, moderately to well preserved ammonoids (Nagm et al. 2010a). Therefore, the present contribution aims to enhance the knowledge about the biostratigraphy of the Upper Cenomanian – Turonian successions in the Eastern Desert based on a large collection of moderately to well preserved ammonoids collected bed-by-bed.

Wadi Araba, situated in the northern part of the Eastern Desert, is bounded by the Galala plateaus in the north and south, and the Gulf of Suez in the east. Four well exposed, highly fossiliferous Cenomanian-Turonian sections have been measured bed-by-bed and sampled in great detail. They yielded a diverse ammonite fauna consisting of 26 taxa, several of which are recorded from Egypt for the first time (Nagm et al. 2010a). The vertical and lateral distribution of these ammonoids has been used to propose an ammonite zonation for the Upper Cenomanian – Turonian Galala and Maghra El Hadida formations (Nagm et al. 2010b). Three zones were recognized in the Upper Cenomanian, from base to top, the *Neolobites vibrayeanus*, *Metoicoceras geslinianum*, and *Vascoceras cauvini* total range zones. The Lower Turonian likewise contains three zones, characterized by the taxon ranges of *Vascoceras proprium*, representatives of the genus *Choffaticeras*, and *Wrightoceras munieri*, respectively. The Middle Turonian is barren of ammonites, and in the lower

Upper Turonian, the *Coilopoceras requienianum* Zone was recognized. The comparison of the biozones as defined in this study to those formerly recognized by other authors in Egypt (Sinai, Eastern Desert) shows a fairly good overlap with a considerable refinement, especially in the Lower Turonian: the elaborated high-resolution subdivision with three ammonoid biozones and five subzones within the *Choffaticeras* spp. Zone refines the existing schemes considerably (bearing in mind the short duration of the Early Turonian of less than one myr, the proposed zonation provides an excellent temporal resolution). All biozones can be correlated, with substantial precision, to the NW European standard zonation based on the occurrences of a few palaeobiogeographically widespread taxa such as *Metoicoceras geslinianum*, *Choffaticeras* spp., and *Wrightoceras munieri*. Furthermore, the proposed biozonation is compared to other Tethyan biostratigraphical frameworks, allowing for more precise interregional correlations.

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Nagm, E., Wilmsen, M., Aly, M. & Hewaidy, A. (2010b): Biostratigraphy of the Upper Cenomanian – Turonian (lower Upper Cretaceous) successions of the western Wadi Araba, Eastern Desert, Egypt. – Newsletters on Stratigraphy, 44(1).

Freie Themen – Poster

Ontogeny of blastoids (Blastozoa): an example of the Middle Devonian hyperoblastids from the Rhenish Massif (Germany)

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Ontogenetic trends among blastozoans are poorly known, mostly because of the lack of appropriate and abundant material. Rare studies have rather focused on the most primitive blastozoans (Middle Cambrian eocrinoids), and the most derived ones (Mississippian blastoids). More than 1000 well-preserved specimens of the fissiculate blastoid species *Hyperoblastus eifelensis* have been recently collected in the Eifelian strata (Middle Devonian) of the Rhenish Massif (Germany). This species is characterised by a long pyriform theca with five wide and subquadrangular radial plates overlapping deltoids. The five ambulacra are deep, linear and narrow. They are mainly preserved as thecae, with neither the food-gathering appendages (brachioles) nor the attachment appendage (stem) preserved. At least one third of the material could be considered as juvenile or immature individuals, based on the size of the theca and the pores.

The main goals of this study are to evaluate the ontogenetic trajectories and the growth deformation changes of *H. eifelensis* and to compare an averaged ontogenetic trend to the few previously published ones for younger blastoid species. Measurements describe the size, shape, and curvature of the theca and its radial plates, the ambulacra and the zone of the stem insertion. Ambulacral growth is evaluated by the relative length and curvature of the ambulacra A and C regarding the length and the curvature of the theca. Preliminary results suggest that the global shape of the theca is relatively stable during growth, the distinction between juveniles and adults being not clear based on these characteristics. The global shape and the curvature of the theca seem to be driven by the growth of the ambulacra.

Symposium K – Vortrag/oral presentation

Environmental context of the Ordovician biodiversification

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Diversification of the marine biosphere is intimately linked to the evolution of the biogeochemical cycles of carbon, nutrients, and primary productivity. Evolving food quantity and quality was primarily a function of broad tectonic cycles that influenced not just carbon burial, but also nutrient availability and primary productivity. Primary production (PP) and phytoplankton in the surface ocean are the base for almost all marine food webs. PP is influenced by the intensity of light, the pCO_2 atmospheric, and the availability of the most important nutrients, i.e. nitrogen and phosphorus. The Early Palaeozoic biodiversification could have been provoked by a changing climate, and a sudden increase of nutrient supply, leading to a rise in primary productivity. At that time, excluding changes in ocean dynamics, the nutrient cycling was probably only influenced by the geodynamics events such as volcanicity and orogeneses, because of the quasi-absence of land plants.

The goals of this work are to reconstruct the Early Palaeozoic climate and nutrient cycle and to test their impact on the diversity increase of benthic fauna during the most important biodiversification event of the Phanerozoic.

Preliminary results show a net decrease of the atmospheric pCO_2 during the Ordovician, to reach a relatively low level in the Late Ordovician-Early Silurian. This decrease is linked to the increase of volcanic rock weathering and to the palaeogeographical changes. PP increases during the Cambrian-Middle Ordovician times, following the increase of volcanic rock weathering. This PP rise coincides with the increase of taxonomic diversity of phytoplankton, followed by the rise of the benthos diversity.

Symposium F – Poster

Quantifying occlusal topography and complexity in non-ruminating mammals

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The mammalian dentition is a segmented organ system with shape differences among its serial homologous elements (individual teeth). Even though a vast amount of tooth shapes and species-specific constructions of extant and extinct species are described, there is still a lack in understanding tooth function and chewing efficiency. Dental function of ungulates, however, can not be understood without considering physiological adaptations of the post-oral digestive system in ruminants and non-ruminants. Both consume nearly identical diet, but differ in tooth morphologies and physiologies. Especially the non-ruminants show diverse herbivorous adaptations and occlusal topographies. Thus, this study focuses on quantifying functional traits within the non-ruminants to infer the evolution of this successful digestive strategy. We test the following hypotheses: (1) the variation of the occlusal topography is correlated with dietary behaviour and (2) functional gradients within the tooth row are linked with chewing dynamics and efficiency. Therefore, we generate digital 3D models of upper post-canine tooth rows of extant non-ruminant taxa using a topometric digitisation system working with a fringe projection technique (smart*SCAN*^{3D}, Breuckmann). A Geographic Information System (SAGA) and an industrial metrology software (PolyWorks, v. 11) are employed to characterise the occlusal topography of 39 individuals of 7 taxa (*Equus grevyi* and *Equus africanus* (Equidae), *Ceratotherium simum* and *Diceros bicornis* (Rhinocerotidae), *Hippopotamus amphibius* (Hippopotamidae), *Hylochoerus meinertzhageni* (Suidae), *Tapirus terrestris* (Tapiridae)). A terrain analysis and semi-automated 3D-tools are implemented to extract structural variables to quantify the total complexity of occlusal geometry. We assume the 3D structural variables to represent functional features of the occlusal morphology for detecting functional homologies among non-ruminants.

Symposium B – Vortrag/oral presentation

New Pliocene mollusk faunas from Chile: filling some gaps in age, diversity and biogeography

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Pliocene marine mollusk faunas from Chile are mainly known from the Coquimbo Formation of central Chile. Three new early to middle Pliocene mollusk faunas from Mejillones Peninsula (northern Chile), the Navidad area (central Chile) and Arauco Peninsula (south-central Chile) were investigated and show little resemblance to the Coquimbo fauna. Because of its faunal composition, the Coquimbo fauna is interpreted to be of late Pliocene to Pleistocene age. The new faunas include several species previously known only from southern Peru and some earliest occurrences are reported. Key species include *Chlorostoma quipua* DeVries, 2007, *Incatella cingulatiformis* (Möricke 1896), *Concholepas camerata* (DeVries 2000), *Chorus doliaris* (Philippi 1887), *Chorus grandis* (Philippi 1887), and *Stramonita zinsmeisteri* (DeVries 2007). These early to middle Pliocene faunas can easily be distinguished from the Miocene Navidad fauna and the younger Plio-Pleistocene fauna and is endemic to the area between southern Peru and south central Chile. It reflects recovery of several taxa after the severe regional extinction of the Navidad fauna which possibly resulted from drastic cooling of seawater surface temperatures which was proposed for the late Miocene. However, many of the typical Pliocene taxa did not survive and have no representatives in the modern fauna. This modern Chilean mollusk fauna has its diversity peak in the south; a feature which developed in the Quaternary after glaciers retreated and left a fractal coastline with a variety of habitats open for colonization.

Symposium B – Vortrag/oral presentation

Early gastropod dominance in Late Paleozoic/Early Mesozoic communities

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Gastropods form one of the most diverse and abundant groups in Recent shelly faunas and have been identified consequently as major component of the „Modern Evolutionary Fauna". Although the expansion of gastropods seems to be a Phanerozoic long term trend, the major radiation has been identified as a relatively recent process (Late Mesozoic to Recent). However, studies on several Late Palaeozoic, Triassic and Early Jurassic faunas suggest that mollusc and especially gastropod dominance or high diversity are older than previously assumed. In these faunas, small gastropods form the most abundant and most diverse invertebrate group. A variety of preservational modes is present in these studied faunas including aragonite preservation and replacement by calcite. As was suggested earlier, lithification of the fossiliferous rocks and the applied sampling techniques seem to play a pivotal role for the preservation of mollusc dominated communities. Low grade lithification facilitates disaggregation of bulk samples and quantitative sampling of faunas including diverse micro-molluscs. Sample standardization of such data sets suggest that at least some Late Paleozoic and Early Mesozoic gastropod faunas were as diverse as their younger counterparts. There are several possible reasons for the great diversity and evolutionary success of gastropods, e.g., a broad range of trophic modes and a high mobility with an effective physiology as well as a broad range of reproductive strategies. This is underlined by the fact that advanced gastropod clades, i.e. Heterobranchia and Caenogastropoda, are most diverse and show the greatest trophic and behavioural plasticity, e.g. they contain extremely diverse parasitic and carnivorous groups. The new results about several Late Paleozoic and Early Mesozoic faunas suggest that such traits are as old as Middle/Late Paleozoic.

Symposium A – Poster

A coral-crinoid biocoenosis from the Middle Devonian of the Eifel Synclines (Rhenish Massif, Germany)

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Biocoenoses among Palaeozoic suspension feeders are relatively well known, especially between brachiopods and crinoids and between tabulate corals and crinoids. By comparison fossilised traces of interactions between rugose corals and other organisms are extremely scarce. Specimens of the rare rugose coral *Aspasmophilum crinophilum* have been recently collected in the Loogh Formation (Lower Givetian; *hemiansatus* Conodont Biozone) from the Eifel region. They are all preserved as attached on camerate crinoid stems. The material has revealed various putative growth stages of the coral. Therefore, the mode of life and the growth of the coral *A. crinophilum* can be newly interpreted.

The coral-crinoid biocoenosis indicates settlement advantages of the rugose coral within densely populated ecological niches of the Lower Givetian. *A. crinophilum* is interpreted as a large epizoozoan, reaching a relative high tiering level by encrusting crinoid stems. Benefits could be the protection against vagile-benthic predators or from sedimentary input and the escape from the ecological pressures (competition for space and food with the other bottom dwelling organisms). The epizoozoan was not lethal for the crinoid, but the local encrustation of the massive coral could have locally reduced the flexibility of the stem. It also shows the ability for the affected crinoid to repel the coral by overcrusting the corallum with a local stereomic overgrowth. Because the crinoid axial canal is not penetrated, the coral cannot be considered as either predator or parasite. Therefore, the described biocoenosis is interpreted as commensalist relationship.

The new material is suitable for the interpretation of the growth history of *A. crinophilum.* The coral larva first settled down on the organic casing of the living crinoid. Then, the juvenile coral apparently started to growth in a single direction. The immature coral next mineralised a skeletal ring around the stem and expanded the size of the cardinal and counter quadrants. Finally, the adult coral spread in size, lengthened all quadrants when closing the ring. Due to the infestation of *A. crinophilum,* three types of crinoid reactions can be described: (1) infestation without crinoid overgrowth, (2) infestation with incomplete overgrowth from the crinoid, and (3) infestation with complete overgrowth from the crinoid.
A new ichnofossil can be attributed to the premortem incrusting of *A. crinophilum* on crinoid stems.

Symposium A – Vortrag/oral presentation

Mikrostruktur und Taphonomie der Schalen des pedunkulaten Cirripediers *Lepas anatifera*

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Die sessilen, in Pedunkulum („Stiel“) und Kapitulum („Kopf“) gegliederten Cirripedier der Ordnung Pedunculata („Entenmuscheln“) gehören mit zu den aberrantesten Arthropoden. Das Kapitulum wird stets von kalzitischen, seltener phosphatischen Schalenplatten umhüllt. Abgesehen von den phosphatischen Schalen der Gattung *Ibla* (Unterordnung Iblomorpha) war deren mikrostruktureller Aufbau bisher unbekannt. Am Modelltaxon *Lepas anatifera* wird erstmalig gezeigt, dass die fünf Kapitular-Platten in der Unterordnung Lepadomorpha einen einfachen, durch mikrogranularen Kalzit geprägten Lagenbau aufweisen. Eine bevorzugte kristallographische Ausrichtung der von organischer (chitinöser) Substanz umhüllten Kalzitkörnchen scheint zu fehlen. Neue Schalenlagen bilden sich durch die sekundäre Mineralisation der organischen Kutikula jeweils nach Häutungsphasen und werden dachziegelartig unter die jeweils zuletzt gebildete Lage angefügt. Dieser Vorgang führt zu geringem Dickenwachstum, aber durch verstärkte Anlagerung am Außenrand der zuletzt gebildeten Lage vor allem zu Größenwachstum. Die Schalenlagen lassen sich auf der Schalenaußenseite als Wachstumsstreifen erkennen und reflektieren die Anzahl der Häutungen. Intern bestehen sie aus hellen und dunklen Mikrolaminae, welche den unterschiedlichen Mineralisationsgrad der ursprünglich organischen (dunklen) Kutikula im Lauf des Wachstums widerspiegeln. Die Schalenaußeneite ist von einer dünnen, nichtmineralisierten Epikutikula überzogen. Sie ist am Außenrand der Schalen verdickt, was eine feste, aber flexible Verbindung der Schalenplatten des Kapitulums ermöglicht. Bei dem geschilderten Wachstumsmodus durch randliche Anlagerung muss die Schale bei der Häutung nicht abgeworfen werden, so dass die Schutzfunktion des Carapax jederzeit vollständig gewährleistet ist. Ein Vergleich mit Schalen anderer Crustaceen zeigt eine vergleichbare lagige Mikrostruktur bei dem pedunkulaten Cirripedier *Ibla*, den ebenfalls zu den Cirripediern gehörenden Sessilia („Seepocken“) und den Spinicaudata („Conchostraken“), das heißt bei Crustaceen mit vergleichbarem Häutungsschema. Dieser spezielle Wachstumsmodus ist somit eine funktionsmorphologische Anpassung und reflektiert nicht zwingend verwandtschaftliche Beziehungen. Schalen fossiler Pedunculata (Scalpellomorpha indet.) aus dem Santonium von Gelsenkirchen (Nordrhein-Westfalen) besitzen einen vergleichbaren mikrostrukturellen Lagenbau. In der kreidig-mikritischen Schale wechseln dichte und poröse Lagen. Die kreidige Konsistenz läßt sich auf die Herauslösung der die Kalzitkristallite umhüllenden Chitinhäute zurückführen, die porösen Lagen auf den geringeren Mineralisationsgrad einzelner Mikrolaminae. Diese Beobachtungen lassen auf eine allgemeine Gültigkeit der beschriebenen Schalenstruktur bei den Pedunculata schließen. Die Schalen von *Lepas anatifera* werden schon zu Lebzeiten von bohrenden Mikroorganismen (z. B. Cyanobakterien der Art *Plectonema terebrans*) pene-

triert. Vergleichbare, post-mortem weitergeführte Bohrungen zeigen sich auch am fossilen Material. Insofern ist sowohl die Mikrostruktur der Schale als auch die Aktivität bohrender Organismen für die schlechte Überlieferung pedunkulater Cirripedier verantwortlich.

Symposium A – Vortrag/oral presentation

Evidence of two new species of *Platypterygius* (Ichthyosauria: Ophthalmosauridae) and their palaeobiogeographical significance from the Torres del Paine National Park, Southern Chile

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The Early Cretaceous ichthyosaurs graveyard at the Tyndall Glacier in the Parque Nacional Torres del Paine, South Chile, is an outstanding locality both nation and worldwide. During two field campaigns in the years 2009 and 2010 40 articulated and semi-articulated ichthyosaur skeletons were discovered, comprising adults, juveniles, babies and embryos. The majority of the ichthyosaur specimens preserve diagnostic features permitting their identification to species level. Until now three different ichthyosaur species were identified in the field: *Platypterygius hauthali* (v. Huene 1927) (Pardo et al. submited), ?*Platypterygius platydactylus* (Broili 1907) and another hitherto unknown species that is different to the other three. This diversity is highly important for the understanding of the diversity in paleocommunities of ichthyosaurs during the Early Cretaceous. The taxonomic and the palaeobiogeographic analysis of the Tyndall ichthyosaur graveyard will throw new light on the evolutionary history of Cretaceous ichthyosaurs prior to their final extinction at the beginning of the Late Cretaceous. The abundance of near complete articulated ichthyosaur skeletons in the Tyndall area suggests mass mortalities caused by high-energy mudflows travelling down along submarine canyons. The ichthyosaurs were either caught directly by these mudflows or were dragged down into the abyss by the suction wave behind them. Their bodies ended up in an abyssal anoxic environment and were rapidly covered by fine sediment, which explains the excellent preservation.

The finding potential of the site as well as the quality of preservation and the quantity of specimens are unique for South America and place the Tyndall ichthyosaur locality among the best fossil sites for marine vertebrates worldwide.

Symposium C – Vortrag/oral presentation

Calcite / Aragonite ratio fluctuations in rudist bivalves: Quantitative data based on serial grinding tomography

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Rudist shells are composed of an outer calcitic and an inner aragonitc shell layer but the relative proportion of calcite and aragonite varies distinctly between families and probably even at the genus level. These variations are linked to the macroevolutionary history of rudist bivalves, which is characterized by quick radiations punctuated and finally terminated by extinction events. Detailed studies of these taxonomic mineralogical shifts are not available due to the lack of a method to obtain reliable quantitative data.

This presentation is focused on the first quantitative data of calcite / aragonite (C/A) ratios of rudist bivalves, quantified with a new tomographic method, based on automatic serial grinding and digital scanning. This method supplied more than 2000 tomograms with a horizontal resolution of 1200 dpi and a vertical resolution between 51 and 254 dpi. In all this data the calcite and aragonite layers were optically analyzed and then quantified with proprietary software. We calculated C/A ratios of the families Requieniidae, Caprinidae, Polyconitidae and Hippuritidae. For example, *Toucasia carinata* has a C/A ratio of 2.54, *Coralliochama orcutti* has a C/A ratio of 0.60, *Polyconites adriani* has a C/A ratio of 1.19 and *Vaccinites sulcatus* has a C/A ratio of 2.76. This information was evaluated with statistical studies and to show that each rudist bauplan has a minimal vertical resolution that still provides reliable data. In the future, C/A ratios might act as a proxy for the acidification events during the Cretaceous. Quantitative, high resolution C/A ratio measurements could also unravel adaptation strategies of reefal ecosystems to environmental change in general.

Symposium G – Vortrag/oral presentation

Planktonic foraminifera: proxies for palaeobathymetry and past sea-surface temperatures? A case history from the early Miocene Upper Marine Molasse Sea

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The ratio between fossil planktonic and benthic foraminifera (P/B-ratio) is widely used to determine water depths of ancient seas. It is known from recent environments that proportional abundances of planktonic specimens usually increase with distance to the shore and increasing water depth. However, the proportional abundances of planktonic specimens found in sediments depend on a number of other factors. Before deposition on the sea floor, dead individuals can be transported

by currents over a long distance, depending on water depth, current velocity, and differential settling velocity of tests. Moreover, calcite dissolution can influence the abundance and proportions of tests in the sediment. Carbonate dissolution is usually found in the deep sea, however, it is also known to occur in shallow water environments (e.g. shelf seas, lagoons, estuaries) because of water masses depleted in calcium carbonate or enhanced organic carbon fluxes. Moreover, planktonic foraminifers are generally much more susceptible to dissolution than benthic forms, leading to depressed P/B ratios.

The P/B ratios of the Ottnangian (early Miocene) Upper Marine Molasse sediments have shown that the values cannot confidently be used in determining palaeodepths. The P/B-ratios are most probably affected by taphonomic processes, including current-dependent transport of dead individuals before deposition on the sea floor and selective carbonate dissolution. Moreover, a restricted connection to the open ocean or brackish water influx could have affected the living assemblages.

In addition, planktonic foraminiferal assemblages are often used for the reconstructions of the palaeotemperatures of surface waters. Studies in modern marine environments have shown that the most conspicuous planktonic foraminiferal distribution patterns are latitudinal. As a result, different biogeographic zones can be distinguished throughout the world based on species composition. Thus, temperature is an important factor in controlling species distributions, however, the influence of temperature correlated phenomena like productivity have been discussed as additional control factors.

The Ottnangian Upper Marine Molasse deposits contain planktonic foraminifers that can be interpreted as typical cold-temperate surface water assemblages. However, high nutrients availability and also selective dissolution may have affected these assemblages. Planktonic foraminifers are not only much more vulnerable to dissolution than benthic foraminifers. Moreover, differences in morphology, test size, wall structure and thickness of their shells result in the effect that some planktonic species are more prone to dissolution than others. Above all, typical warm water taxa tend to be easily dissolved, whereas most cold water species are more resistant. We conclude that detailed analyses of fossil planktonic foraminifers using high resolution microscopy are necessary for a reliable palaeoenvironmental interpretation.

Symposium E – Vortrag/oral presentation

„Arms race“ in the Mesozoic: bennettitalean response to insect feeding

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The record of arthropod damage to plants extends back to at least the Early Devonian. Damage caused by arthropods, especially insects and mites, is readily recognised in plant fossils since these groups produce a range of distinctive external feeding, mining, piercing and sucking, oviposition, and galling traces. Of these, feeding traces are the most abundant. To avoid damage to foliage and other organs, modern plants generally possess an elaborate range of defensive adaptations. Constitutive mechanisms include those that have inhibitory effects on herbivory and are usually expressed morphologically. For example, thorns, spines and epicuticular wax structures, or hairs, hamper insects physically landing on leaves or constrain their crawling and walking over the leaf surface. Induced defence mechanisms are usually immediate reactions to direct damage by herbivores. They are commonly of a chemical nature (e.g. resinous exudates) and are less energy-consuming since it is not necessary for the plant to maintain them permanently. Such chemical defences are, however, hard to identify in fossils, whereas the former are readily recognisable in compression fossils, when cuticle is preserved.

Extensive and elaborate studies of plant/insect-interactions in the fossil record have been published over the last decade. However, these studies have generally focused on the damage caused by insects (mainly herbivory), while the view from the plants' perspective (i.e., their responses and defence mechanisms) has received little attention, apart from the production of galls in response to internal damage. Although these ancient 'arms races' (herbivory and defence mechanisms) have been only little studied, strategies involving the development of novel feeding parts (in arthropods) and inhibitory structures (in plants) are likely to have been some of the major selective pressures driving the evolution of the terrestrial biota.

During a visit of the collections of the Institute of Geology and Palaeontology in Nanjing, China, we found some undescribed bennettitalean fossils from the Daohugou Bed from near Chifeng (Inner Mongolia), which show a striking development of response to obvious plant damage caused by insects benefitting from the tasty plant tissue. These fossils may give a rare insight in the development of such 'arms races' strategies.

Symposium F – Poster

The faunas from Ichenhausen

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Although the deposits of the Upper Freshwater Molasse have been intensively investigated, the study of the Miocene faunal evolution in the German part of the North Alpine Foreland Basin suffers from the lack of long and continuous sedimentary successions. In this context, the nearly 40 m thick section of Ichenhausen, which contains at least seven layers that are rich in vertebrate and invertebrate fossils, provides a unique opportunity to document qualitative and quantitative faunal changes.

The locality: The Ichenhausen section (Bavaria, 48° 22.490

N and 10° 19.070 E) is composed of monotonous, blueish–gray marly deposits that correspond to the "Untere Limnische Serie" lithostratigraphic unit (*sensu* Doppler 1989). In detail, the sediments comprise several segments of fining-up sequences that consist of a succession of fine-grained sands, silts, and muds. On top of the mud layers, 10–30 cm thick dark marly horizons (layers ICH -1 to ICH 7) that are usually rich in fossil molluscs, terrestrial vertebrates, and fish remains, are discernable. Recently, another rich fauna (ICH 8) was discovered in yellow sands that erosively overlie the fine-grained sediments.

Dating: The mammalian biostratigraphic investigations indicate that the base of the succession (ICH -1) belongs to the local unit OSM B, whereas the size increase observed in *Megacricetodon* permits to correlate the upper portion of the deposits with OSM C+B (ICH 3-7). The otolith assemblages confirm this correlation (upper part of zone OT-M5). Finally, palaeomagnetic studies suggest a correlation of the entirely inverse magnetized section to chron 5Cr at the base of the Karpatian. The fauna ICH 8 is still under study.

The faunas and their environment: A large majority of the fossils excavated at Ichenhausen are small terrestrial vertebrates, fish otoliths, -teeth, -bones, and molluscs. Important changes in the depositional environment, illustrated by lake level fluctuations, and the periodical influence of the surrounding meandering fluvial system are recorded in the ectothermic vertebrate and mollusc assemblages, but also in the small mammal record, with important variations in the taxonomic composition of the faunas. ICH 8 shows a higher α-diversity with regard to terrestrial vertebrates, corresponding to the fluviatile origin of the sediments.

Symposium I – Vortrag/oral presentation

In vitro regulation of $CaCO_3$ crystal growth by the highly acidic proteins of calcitic sclerites in soft coral, *Sinularia polydactyla*

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Acidic proteins are generally thought to control mineral formation and growth in biocalcification. Analysis of proteinaceous components in the soluble and insoluble matrix fractions of sclerites in *Sinularia polydactyla* indicates that aspartic acid composes about 60% of the insoluble and 29% of the soluble matrix fractions. We previously analyzed aspartic acids in the matrix fractions (insoluble=17 mol%; soluble=38 mol%) of sclerites from a different type of soft coral, *Lobophytum crassum,* which showed comparatively lower aspartic acid-rich proteins than *S. polydactyla*. Thus, characterization of highly acidic proteins in the organic matrix of present species is an important first step toward linking function to individual proteins in soft coral. Here, we show that aspartic-acid rich proteins can control the $CaCO_3$ polymorph *in vitro*. The $CaCO_3$ precipitates *in vitro* in the presence of aspartic acid-rich proteins and 50mM Mg^{2+} was verified by Raman microprobe analysis. The matrix proteins of sclerites demonstrated that the aspartic-acid rich domain is crucial for the calcite precipitation in soft corals. The crystalline form of $CaCO_3$ in the presence of aspartic acid-rich proteins *in vitro* was identified by X-ray diffraction, revealing calcitic polymorphisms with a strong (104) reflection. The structure of soft coral organic matrices containing aspartate-rich proteins and polysaccharides was assessed by Fourier transform infrared spectroscopy. These results strongly suggest that the aspartic acid–rich proteins within the organic matrix of soft corals play a key role in biomineralization regulation.

Symposium D – Poster

Das Randecker Maar: ökologische und klimatische Proxies eines untermiozänen Kratersees

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Das Randecker Maar ist ein fossiler Kratersee am Rande der Schwäbischen Alb (Baden-Württemberg). Es ist Teil des Urach-Kirchheimer Vulkanfelds und entstand im Unter-Miozän durch Explosionen beim Kontakt von aufsteigendem Magma mit Grundwasser. Das Randecker Maar ist bekannt für seine gut erhaltenen Fossilien, allen voran Pflanzen und Insekten. Den besten Erhaltungszustand findet man in Warven und im Dysodil.

Trotz der Bekanntheit dieser Lokalität an sich weiß man überraschend wenig über die Entwicklung dieses Kratersees: Obwohl zehntausende Fossilien in verschiedenen Museen gelagert sind, wurde der Sedimentologie und Taphonomie wenig Beachtung geschenkt. Auch fehlen für die meisten Organismengruppen modernere taxonomische und palökologische Bearbeitungen.

Im Jahr 2009 begann das Staatliche Museum für Naturkunde Stuttgart mit einer auf mehrere Jahre hin angelegten Grabung, deren Ziel es ist, diesen Ablagerungs- und Lebensraum mit modernen sedimentologischen, paläontologischen und geochemischen Methoden neu zu bearbeiten. Bei der ersten Grabungskampagne wurde ein 2,50 Meter mächtiges Profil feinschichtiger Warvensedimente freigelegt und hoch auflösend beprobt. Die geringe Mächtigkeit der einzelnen Lagen weist auf einen Sedimentationszeitraum von bis zu 5000 Jahren für diese Sequenz hin. Deutliche Schwankungen im Karbonatgehalt zeigen schwankende klimatische Bedingungen an, die gerade ausgewertet werden.

Bei der Grabung wurden mehrere hundert Fossilien geborgen, darunter vor allem Pflanzenreste, Insekten mit Farbmustererhaltung, Gastropoden, Ostracoden, Amphiben- und Vogelreste sowie eine fast vollständige Fledermaus. Während die Insekten kürzlich in der Diplomarbeit von C. Joachim neu bearbeitet wurden, werden zurzeit Pflanzen, einschließlich

der Pollen, in einer Dissertation bearbeitet (siehe Poster von F. Göhringer). In weiterer Folge werden von der Stuttgart-Tübinger Arbeitsgruppe sedimentologische Aspekte sowie sämtliche Organismengruppen bearbeitet, in der Folge auch mit geochemischen Methoden.

Symposium J – Poster

New reptiles from the Mörnsheim Formation of Mühlheim, Bavaria

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The Late Jurassic marine limestone sequences of southern Germany are famous for their excellently preserved fossils, and many important taxa of Jurassic reptiles have been described from these rocks in the past 250 years, ranging from turtles, via lepidosaurs, crocodiles, pterosaurs, dinosaurs, to the still oldest known bird, *Archaeopteryx*. Although reptile fossils are known from layers ranging from the Early Kimmeridgian to the Middle Tithonian, the vast majority of remains have so far been recovered from the Early Tithonian Solnhofen Formation, which has been quarried extensively for lithographic limestones and building materials. However, the overlying Mörnsheim Formation actually seems to be more fossiliferous than the famous Solnhofen Formation, but the vast majority of known specimens come from a single outcrop area in Daiting, Bavaria. Recently, a new quarry has been opened in the Mörnsheim Formation at Mühlheim, near Mörnsheim. Here, some 25 m of the approximately 40 m of the formation are exposed. At Mühlheim, the Mörnsheim Formation reveals a more heterogenous sediment character than the underlying Solnhofen Fm., consisting of mainly siliceous, platy limestones in alternate bedding with marly and limey sections, and with intercalated banks up to 70 centimeters mainly in the lower to middle parts of the section. Fossils are abundant, but fossil distribution and taxonomic composition varies considerably between different layers. Fossils include plants, a range of invertebrates, fish fossils that are abundant in several layers, and some reptile remains, which also seem to be concentrated in a single layer within the lower part of the exposed sequence.

Several new reptile specimens have been discovered. One of the most remarkable discoveries is that of the skull and lower jaws of a new taxon of sphenodontid rhynchocephalians. The new taxon shows numerous autapomorphic characters, including the development of a tooth plate in both the maxillae and dentaries. This plate, which seems to be formed by a multitude of interwoven dentine bundles, is a unique dental adaptation within tetrapods, and indicates a durophagous diet for the new taxon, a lifestyle not previously reported for rhynchocephalians. However, despite the highly apomorphic nature of the new taxon, phylogenetic analysis places it within the groups that includes the only living representative of the Sphemodontia, the Sphenodontinae, indicating that these animals show a higher adaptive plasticity than often assumed. A second specimen consists of a complete skull, lower jaws, and associated postcrania of the pterosaur *Ctenochasma*, one of the rarest pterosaur genera from the Late Jurassic of southern Germany. The skull is the best-preserved and largest skull known for *Ctenochasma*, and differs from other specimens of this genus by its relatively more elongate and slender snout and the preservation of a low bony crest on the posterior part of the premaxillae, indicating that it might represent a new species. A third noteworthy specimen from the Mühlheim quarry is a complete skull, lower jaws, and associated postcrania (including an almost complete, articulated tail) of a large metriorhynchid crocodile. The skull shows characters that seem to be intermediate between the "typical" *Geosaurus* specimens from the Late Jurassic of Germany and the enigmatic *Dakosaurus*. Thus, a detailed study of this new specimen might provide important new information on the evolutionary history of the Metriorhynchidae in the Late Jurassic.

Freie Themen – Poster

How many species of fossil holothurians (Echinodermata) are there?

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Compared to other modern echinoderm groups, the evolutionary history and diversity of sea cucumbers (Echinodermata) is poorly understood. A total of more than 1,400 valid species of Recent Holothuroidea was reported recently – but how many species of fossil sea cucumbers are there?

In 1954 J. Wyatt Durham reported ~ 115 valid fossil holothurian species names, and some years later, Don L. Frizzell and Harriet Exline catalogued 128 and respectively 153 fossil species in 1956 and 1958. In the *Treatise on Invertebrate Paleontology* (1966), both authors listed 295 holothurian paraspecies and species. In the next decades, the total number of fossil sea cucumber species increased: 454 (1980), 559 (1993), 794 (2004) based on sclerites and body fossils.

Here, I offer a modern summary of fossil holothurian diversity and the most important localities (Fossillagerstätten) of holothurian body fossils as a baseline for future research. The species-level diversity of fossil Holothuroidea is summarised for each geological period since Ordovician times. In chronological order they are: Ordovician (6 published fossil paraspecies / species names), Silurian (0), Devonian (41), Carboniferous (68), Permian (26), Triassic (256), Jurassic (266), Cretaceous (92), Paleogene (103), Neogene (43), Quaternary (17). Based on a compilation of more than 1,300 primary literature references on fossil sea cucumbers, around 600 valid species can be recognised from 917 published names. Triassic and Jurassic holothurian taxa thus appear to dominate the fossil record, compared to their Phanerozoic diversity. By contrast, Early and Late Paleozoic as well as Neogene holothurians are noticeably under-represented as fossils, due to different reasons.

Symposium G – Poster

Middle Miocene holothurians (Echinodermata) from Austria

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Compared to other modern echinoderm groups, the evolutionary history of holothurians is poorly understood, owing to their preservation almost exclusively as microfossil. In comparison to older strata, the Cenozoic fossil record of sea cucumbers is particularly scarce. This is in stark contrast to most other invertebrate groups, in which the fossil record tends to improve with declining age.

The Central Paratethys (Europe) is one of the most intensely studied Neogene basins and has yielded a rich echinoderm fauna including representatives of all moden echinoderm classes. Unfortunately, most of the holothurian sclerites reported from that area by previous authors have been lost. Here we present new data based on a survey of old micropalaeontological samples (second half of the 19th century), deposited in the Natural History Museum of Vienna, as well as new samples collected from deposits rich in echinoderm remains. The samples studied derive from silty clays and marls from the Austrian part of the Vienna Basin and are Badenian (= Langhian to Early Serravallian) in age. The samples were processed to preserve the fine fractions needed for the successful recovery of holothurian sclerites. Out of more than twenty-five samples, only two yielded well-preserved holothurian echinoderms.

The present material includes most of the sclerite morphotypes reported by earlier authors and thus allows a critical review of the numerous holothurians parataxa introduced for Paratethyan material, based on sclerite association based taxon reconstruction.

At least ten biological species of the Molpadiida (Molpadiidae), Dendrochirotida, Aspidochirotida (Holothuriidae), Apodida (Synaptidae, Chiridotidae, and Myriotrochidae) could be documented in form of sclerites from the body wall, as well as calcareous ring elements. Especially the classic „Badener Tegel"-samples of Baden near Wien (former brickyards between Baden and Sooss) yielded exceptionably well-preserved material. Infaunal molpadiid representatives dominate the faunal holothurian association of the „Badener Tegel". This includes the first fossil record of small amorphous ferric phosphatic dermal granules, which are typical for members of the Molpadiidae and a unique biomineralogical phenomenon for the Echinodermata as a whole. The recorded holothurians are deposit feeders (Molpadiida, Aspidochirotida, Apodida) and suspension feeders (Dendrochirotida) with an epibenthic or cryptic (Aspidochirotida, Dendrochirotida in part) as well as an infaunal/semi-infaunal (Molpadiida, Apodida) lifestyle. The associated echinoderm fauna consists mostly of cidaroid and spatangoid echinoids and disarticulated ophiuroid and asteroid ossicles.

The new holothurian finds and the assemblage support in part the assumption that the echinoderm palaeo-community of the „Badener Tegel" is characteristic for low-energy mud-bottoms below the photic zone. The deposition of the sediment occurred at a water depth of around 200 m in a relatively warm, well-stratified water column within the Vienna Basin of the Central Paratethys.

Freie Themen – Poster

Aus dem Archiv der Paläontologischen Gesellschaft IV: Mitglieder

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Mitglieder von Vereinigungen und Zusammenschlüssen sind immer der jeweilige „Motor und das Herz" einer jeden wissenschaftlichen Gesellschaft. Im Zuge der derzeitigen Aufarbeitung der Geschichte unserer Gesellschaft wurden die im Göttinger Archiv der Gesellschaft befindlichen Bestände an unveröffentlichten und veröffentlichten Mitgliederdaten (Verzeichnisse, Anmeldebögen, Karteikarten etc.) eingehend analysiert. Nach dem Aufruf zur Gründung unserer Gesellschaft im Mai 1912 durch Otto Jaekel (Greifswald) und ihrer Gründung am 12. August desselben Jahres traten 143 Personen der Gesellschaft bei und zwei Ehrenmitglieder wurden ernannt. Das erste Mitgliederverzeichnis von 1913 nennt schon drei Ehrenmitglieder sowie 214 ordentliche („persönliche") Mitglieder aus 27 Ländern, darunter auch zwei Frauen, Jenny Scherber (1873–1950, Berlin) und A. Hintze (Kopenhagen), in dem zu jener Zeit von Männern dominierten Fach der Paläontologie.

Einschneidende negative politische Ereignisse (Weltkriege, Wirtschaftskrisen, Nationalsozialismus) spiegeln sich auch in den Mitgliederzahlen unserer Gesellschaft wider. Dies läßt sich auch am Anteil ausländischer Mitglieder aufzeigen, so waren es 1913: 40 %, 1923: 30 %, 1930: 36 %, 1939: 32 % und 1951: 21 % der Mitglieder. Nach einem Hochstand 1975 mit 33 % ausländischen Mitgliedern, fiel der Prozentsatz kontinuierlich: 1990: 20 % und 1994: 18 %; derzeit hat sich dieser leicht erholt (2010: 19 %).

Bisher weitgehend unaufgearbeitet blieb in unserer Gesellschaft der Zeitabschnitt 1933 bis 1945 – insbesondere nach Umbenennung in die „Deutsche Paläontologische Gesellschaft" ab 1936 (bis 1945) – hinsichtlich Ausschluß von „unerwünschten", z. T später in das Ausland emigrierten (z. B. Tilly Edinger *1897–†1967, Curt Teichert *1905–†1996) oder ermordeten (Rudolf Kaufmann *1909–†1942) Mitgliedern.

Der am 13. Oktober 1948 wiedergegründeten Gesellschaft gehörten im September 1951 215 Mitglieder (inkl. vier Ehrenmitglieder) an, wovon 46 (21 %) aus dem Ausland (16 Länder) kamen. Trotz verschiedentlicher Einschnitte ist die Mitgliederzahl bis heute kontinuierlich gewachsen und beträgt derzeit 1045 Mitglieder (Stand: Juli 2010) aus 35 verschiedenen Ländern.

Dem von Otto Jaekel bei Gründung der Paläontologischen Gesellschaft propagierten Zusammenschluß aller „deutschsprachigen Paläontologen“ wurde durch Gründung weiterer nationaler Gesellschaften in der Schweiz (1921) und Österreich (1966) zwar entgegengewirkt, jedoch blieb die Zahl von österreichischen (5–40, 2–10 % der Gesamtmitglieder) und schweizerischen (1–23, 0,5–3 % der Gesamtmitglieder) Mitgliedern stets hoch, gemessen an den Gesamt-Mitgliederzahlen. Auch Mitglieder aus den USA waren seit Gründung der Gesellschaft stetig in größerer Zahl vertreten (5–31, 2–11 % der Gesamtmitglieder). Demgegenüber waren (und sind) z. B. Mitglieder aus Frankreich (0–14, 0–2 % der Gesamtmitglieder) und England (1–14, 1–2 % der Gesamtmitglieder) in nur sehr geringer Anzahl vertreten.

Vorliegender Posterbeitrag soll einen Überblick über die Entwicklung und Zusammensetzung der Mitglieder unserer Gesellschaft geben. Den Ehrenmitgliedern (insges. 63), sowie korrespondierenden Mitgliedern (21) bleibt ein eigener Beitrag vorbehalten.

Freie Themen – Poster

A new deep-sea holothurian representative (Echinodermata) from the Early Devonian Hunsrück Slate Fossillagerstätte

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Among all five groups of modern Holothuroidea, the elasipodid sea cucumbers are unique in being confined to the deep sea. There are nearly 150 species of 5 families widely distributed in depths over 200-400 m, and many of them are cosmopolitan in distribution. Elasipodid holothurians are characteristic of abyssal depths, where they can be found in deepest trenches, constituting up to 90 % of the total biomass. All elasipodids are strongly bilaterally symmetrical, and they often possess bizarre body forms with elongate projections or transparent veils, whereas the body wall of these forms is fragile and often quite gelatinous. Consequently, the fossil record of elasipodid holothurians is very poor and incomplete. Approximately half of all modern members of Elasipoda are believed to be capable of swimming, and a few species apparently spend most of their life swimming. Elasipods are divided into families based primarily on their calcareous body wall ossicles and calcareous ring structure.

While studying „*Palaeocucumaria*“ specimens from the Early Devonian (Emsian) Hunsrück Slate, we came across two sea cucumbers that were clearly different. These two new specimens are considerably larger than the previously known „*Palaeocucumaria*“ specimens from the Hunsrück Slate and show no evidence of having the large plated tube-feet that characterise that genus. Furthermore, detailed inspection using X-ray computed tomography of the calcareous ring preserved *in situ* shows it to be composed of 5 interradial and radial elements the latter x-shape having typically 4 processes as in modern deimatid deep-sea holothurians.

The new find represents the first unequivocal record of an deep-sea holothurian body fossil from the Palaeozoic, and it implies a deep split between Deimatidae and Laetmogonidae (Elasipoda). This indicates that crown group holothurian divergence had taken place by the early Devonian as suggested recently by the authors. Furthermore, the new genus and species is the earliest holothurian body fossil in which there is a clear differentiated sole and ventral mouth – implying this to have been an epifaunal detritus feeder. The next youngest body fossil with a sole was reported from the Middle Triassic.

Finally, there is one open question: It is widely accepted that the water depths represented by the Hunsrück Slate did not exceed 200 m, so when did elasipodid holothurians disappear from the continental shelf record?

Freie Themen – Poster

Apodid holothurians (Echinodermata) from the Mazon Creek Fossillagerstätte (Illinois, USA)

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The Mazon Creek biota of northeastern Illinois provides the most complete record known of late Palaeozoic life. All fossils occur almost exclusively in siderite concretions in the Francis Creek Shale Member of the Upper Pennsylvanian Carbondale Formation (Westphalian D). This Fossillagerstätte is famous for organisms with non-mineralised skeletons, like hydrozoan, scyphozoan and cubozoan cnidarians, or priapulid and echiurid „worms”. Apart from one single crinoid specimen, the only other echinoderm found is a holothurian, which is actually quite common in the Essex fauna (Pit 11) of the southern Mazon Creek area. The holothurian was often listed or named as „*Achistrum*”, but this is actually a paragenus name for hook-like ossicles. In contrast to the Braidwood fauna, the Essex fauna represents a brackish and restricted marine habitat, associated with a deltaic environment.

After a first mention in the 1950s by Eugene Richardson, these findings were negated over decades. It is suprising that only two preliminary descriptions exist up to now regarding the sparse holothurian fossil record, consisting mostly of disarticulated material.

During the last years, we studied more than 3,500 holothurian specimens, mostly deposited in the Royal Ontario Museum in Toronto, Canada. At the present stage of our work, all specimens represent a single chiridotid species of the Taeniogyrinae (Apodida) with a body length of 2–11 cm and a diameter of 0.5–1.5 cm. Well-preserved specimens contain a typical apodid band-like calcareous ring (diameter 4 mm) of 5 interradial and 5 radial elements as well as hook-shaped ossicles of bimodal size (150–250 µm and 550–800 µm), comparable to modern taeniogyrinid sigmoid rods. Mostly all ossicles *in-situ*

are clearly arranged in rows as in modern forms. Soft-tissue preservation is known from gut traces, but no tentacles have yet been clearly observed.

Numerous fossils of the Mazon Creek biota suggest rapid deposition, e. g. buried in life position, which we can also assume for all well-preserved holothurians. There are also a few comparable modern brackish environments with burrowing, small to medium-sized, apodid holothurians.

This new genus and species represents the only holothurian body fossil with body wall ossicles and the entire calcareous ring preserved *in situ* as well as soft-tissue preservation. It also implies a deep split between all apodid families and a very early diversification of this group, as suggested recently by the author.

Freie Themen – Poster

Aus dem Archiv der Paläontologischen Gesellschaft V: Tagungen

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Die jährlichen Tagungen unserer Paläontologischen Gesellschaft gaben und geben unseren Mitgliedern, aber auch zahlreichen Gästen und eingeladenen Wissenschaftlern, die Möglichkeit zur Präsentation von Ergebnissen ihrer Forschungen, gestatten aber auch den fachlichen Austausch und die Pflege sozialer Kontakte innerhalb der paläontologischen Gemeinschaft. Während dieser Jahrestagungen (bis 1980 Jahresversammlungen genannt) findet außerdem die jährliche Mitgliederversammlung (u. a. mit den Wahlen zu Vorstand und Beirat) statt. Ebenso werden verschiedenste Exkursionen und neuerdings auch Workshops zu aktuellen Themen angeboten.

Seit der ersten Versammlung in Halberstadt (05.-06. September 1912) fanden bis 2009 insgesamt 80 Jahrestagungen statt, wobei in den Jahren 1914–1920, 1932 und 1940–1949 (meist aus politischen Gründen) keine Jahresversammlungen abgehalten wurden.

Insgesamt 50 Orte im In- und Ausland wählte die Paläontologische Gesellschaft seit 1912 zu ihren Austragungsorten. Neben verschiedensten, meist universitären und musealen Standorten in Deutschland, gab es auch solche in Österreich (6x), der Schweiz (3x), Ungarn (2x), den Niederlanden (1x), Belgien (1x), der Tschechischen Republik (1x) und Großbritannien (1x). Am häufigsten trafen sich die Mitglieder unserer Gesellschaft in Tübingen (1922, 1929, 1939, 1953, 1962, 1980; davon 1929 und 1939 zusammen mit Stuttgart), gefolgt von Berlin (1936, 1959, 1992, 1998), Göttingen (1926, 1937, 1977, 2004) und München (1950, 1960, 1985, 2010). Einige dieser Veranstaltungen wurden mit anderen wissenschaftlichen Gesellschaften durchgeführt, wie z. B. mit der Deutschen Geologischen Gesellschaft (als sogenannte GEO-Tagungen auch mit anderen erdwissenschaftlichen Gesellschaften zusammen, z. B. 1977, 1984, 1998, 2002) und der Gesellschaft für Biologische Systematik (2001).

Eine Zählung unserer Jahrestagungen (Jahresversammlungen) wurde traditionell nicht durchgeführt sondern immer mit der jeweiligen Jahreszahl verbunden.

Bei der Einführung der Zählung vor nunmehr 30 Jahren (*Paläontologie aktuell* 2, 1980) ist jedoch ein Fehler unterlaufen, so daß es sich bei der diesjährigen Jahrestagung in München keinesfalls um die 80. sondern bereits um die 81. Jahrestagung der Paläontologischen Gesellschaft handelt. Es bleibt zu hoffen, daß dieser Fehler bis zum Jubiläum (100 Jahre Paläontologische Gesellschaft) im Jahr 2012 korrigiert werden kann.

Symposium J – Vortrag/oral presentation

Diversity, functional morphology and mode of life of the Late Triassic drepanosaur reptiles

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Drepanosaurs are a group of highly specialized, arboreal reptiles of the Late Triassic with a paleogeographic range throughout North America and Western Europe. While these forms exhibit different sizes and slightly diverse body form, all share the same body plan that unequivocally demonstrate their close relationships. Seven drepanosaur taxa have been erected so far: *Drepanosaurus unguicaudatus* Pinna, 1980, *Megalancosaurus preonensis* Calzavara Muscio and Wild, 1980; from the Dolomia di Forni (Forni Dolostone, Northern Italy) and from the Calcare di Zorzino (Zorzino Limestone, Northern Italy) both of Norian (Late Triassic) age and *Megalancosaurus endennae* Renesto, Spielmann, Lucas and Tarditi-Spagnoli, 2010, from the Calcare di Zorzino, *Dolabrosaurus aquatilis* Berman & Reisz, 1992 from the Petrified Forest Formation, Chinle Group, New Mexico, *Hypuronector limnaios* Colbert & Olsen, 2001, from the Newark Supergroup *Vallesaurus cenensis* Renesto and Binelli, 2006, and *Vallesaurus zorzinensis* Renesto, Spielmann, Lucas and Tarditi-Spagnoli, 2010, from the Calcare di Zorzino. Additional fragmentary drepanosaur remains have been collected from late Carnian in North America from latest Norian/Rhaetian in North America and the United Kingdom. The analysis of the functional morphology of drepanosaurs skeleton confirms the adaptation to scansorial, especially arboreal, locomotion in all drepanosaurs including the supposed aquatic taxon *Hypuronector limnaios.* Most drepanosaurs were insectivorous, and the notarium-like structure present in some drepanosaurs may have been related to head projection in prey capture.

Phylogenetic analysis lead to rejection of previous drepanosaurid taxonomy, specifically the clade Avicephahla.

Symposium J – Poster

Stratigraphic significance of a new finding of *Neusticosaurus* from the Meride Limestone (Ladinian, Middle Triassic, Monte San Giorgio Switzerland)

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A new excavation in the Cassina beds of the Lower Meride Limestone (Monte San Giorgio UNESCO WHL, Canton Ticino, Switzerland) started by the Museo Cantonale di Storia Naturale of Lugano (Switzerland) has yielded so far several fishes belonging to different taxa and a pachypleurosaurid specimen which is identified as *N. peyeri*.

The attribution of specimen MCSN 8076 to *Neusticosaurus peyeri*, as suggested both by morphological and morphometrical data, raises some questions about the strict correlation between pachypleurosaurid taxa and fossiliferous horizons in the Monte San Giorgio basin as originally proposed by Sander (1989) and by O'Keefe & Sander (1999). According to these authors, in the Cassina beds only *N. edwardsii*, the youngest and largest *Neusticosaurus* species, should occur.

The resulting co-occurrence of *N. peyeri* and *N. edwardsii*, suggests that the hypothesis of a single anagenetic lineage in *Neusticosaurus* species from Monte San Giorgio should be reconsidered along with the phylogenetic inferences about *Neusticosaurus* evolution in the Monte San Giorgio area. The stratigraphic distribution of the *Neusticosaurus* species in the Monte San Giorgio basin is updated on the basis of the recent findings.

O'Keefe, R. F. & Sander, M. (1999): Paleontological paradigms and inferences of phylogenetic pattern: a case study. – Paleobiology 25: 518–533.

Sander, M. P. (1989): The pachypleurosaurids (Reptilia: Nothosauria) from the Middle Triassic of Monte San Giorgio (Switzerland) with the description of a new species. – Philosophical transactions of the Royal Society of London B 325: 561–670.

Symposium F – Vortrag/oral presentation

Ein neues Taxon didactyler Theropoden-Fährten aus dem Mitteljura der Rep. Niger, Afrika

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An einer neue Fundstelle in der Ebene von Agadez (Rep. Niger, Nordwest-Afrika) aus dem Mittleren Jura, der so genannten Irhazer-Site, wurden exzellent erhaltene didactyle Fährten von zweibeinig laufenden, digitigraden Fährtenerzeugern gefunden. Die charakteristische Morphologie der Trittsiegel deutet auf einen maniraptoren Theropoden aus der Gruppe der Paraves hin, die eng mit den heutigen Vögeln verwandt ist. Aufgrund des Alters und der morphologischen Besonderheiten wird für diesen Fährtentyp ein neues Taxon aufgestellt und beschrieben.

Es handelt sich bei den ca. 120 Trittsiegeln um didactyle Abdrücke der Zehen III und IV, die häufig so tief eingetreten sind, dass auch der Ballen der modifizierten Zehe II einen kleinen ovalen Abdruck auf dem Sediment hinterlassen hat. Die mittelgroßen Trittsiegel sind im Durchschnitt 27,5 cm lang und 23,1 cm breit.

Die lithologische Einheit, in der sich die fährtentragende Schicht befindet, gehört zu den so genannten „Argiles de l'Irhazer" (Irhazer-Tonstein). Ein paläobiologischer Vergleich des 2009 beschriebenen Sauropoden *Spinophorosaurus nigerensis* aus der Irhazer-Fundstelle mit Sauropoden aus anderen mitteljurassischen Lokalitäten deutet darauf hin, dass es sich bei der Fährtenschicht um Sedimente aus dem Mittleren Jura handelt. Die vergleichenden Studien von Rauhut & López-Arbarello (2009), in denen alle verfügbaren Datierungsdaten berücksichtigt wurden, ergaben für die Tiouraren Formation ein Alter, das vom oberen Mitteljura bis zum unteren Oberjura reicht. Der darunter liegenden Irhazer-Tonsteins, in dem der Fährtenhorizont liegt, ist demnach dem oberen Mitteljura zuzuordnen. Die Fährtenschicht besteht aus einem 3-5 cm mächtigen feinkörnigen Sand- und Siltstein, der durch saisonale Überflutungen eines aktiven Wadisystems freigelegt wurde. Alle Trittsiegel sind in der Originalschicht erhalten, meist noch ausgefüllt mit dunkelrotem Tonstein, der über der Fährtenschicht lag.

Das neue Ichnotaxon nimmt eine einzigartige Stellung im Fossilbeleg von Gondwana und innerhalb des Mittleren Jura weltweit ein, da es sich um die früheste Überlieferung eines Maniraptoren aus der vogelnahen Gruppe der Paraves und den Erstnachweis von didactylen Fährten in Afrika handelt.

Symposium D – Vortrag/oral presentation

Die eruptionsnahe Überlieferung eines permischen Ökosystems – Neue Forschungen im Versteinerten Wald von Chemnitz

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Seit dem Mittelalter werden im Untergrund vom Chemnitz versteinerte Bäume gefunden. So wurde die Stadt zu einem der reichsten Fundorte dreidimensional überlieferter permischer Pflanzenfossilien auf der Erde. Nur hier wurden die Funde auch unverzüglich erforscht, öffentlich ausgestellt und allgemeinverständlich erklärt – seit über 150 Jahren. Die meisten Exponate der letzten Jahrhunderte waren jedoch Zufallsfunde, Grund genug für das Team des Museums endlich systematisch nach dem geheimnisvollen Schatz unter Chemnitz zu graben. Was mit einer Idee begann, ist seit April 2008 Realität. Spekta-

kuläre Funde, u.a. das „Fossil des Jahres 2010“ berichten über Leben und Sterben einer tropischen Oase, über die zerstörende Kraft und konservierende Wirkung explosiven Vulkanismus'.

Erstmals erfolgte eine großflächige und umfassende Beprobung und Dokumentation des basalen Zeisigwald-Tuffs im eruptionsnahen Bereich. Innerhalb der systematisch abgegrabenen Profilabschnitte wurden Gefügemerkmale der Gesteine, die Fossilführung und die taphonomischen Besonderheiten erfasst und im Kontext der Eruptions- und Ablagerungsdynamik interpretiert.

Bislang konnten auf dem Grabungsareal über 40 aufrecht (*in-situ*), d.h. in Wuchsposition befindliche Pflanzenachsen nachgewiesen werden, die im sedimentären Rotliegend (Schicht 6) entspringen und unterschiedlich weit in die auflagernden Pyroklastite hinein reichen. Die mächtigsten Stämme durchstoßen die gesamte aufgeschlossene Schichtenfolge, bestehend aus dem feinklastischen, horizontalschichtigen b-Horizont (Schicht 5), der an seiner Basis als „Blatthorizont“ in Erscheinung tritt; den geringmächtigen, stark lithifizierten, an akkretionären Lapilli reichen Aschentuff der Schicht 4 und den massiven großblockigen Tuff der Schicht 3. Während die Sedimentationsmuster und taphonomischen Charakteristika der Schicht 5 für einen in westlicher Ausbreitungsrichtung sedimentierten Air-Fall-Tuff sprechen, ist innerhalb von Schicht 4 eine Erhöhung des phreatischen Charakters im Eruptionsgeschehen zu konstatieren. Ab Schicht 3 dominieren Lateralkomponenten im Ablagerungsgeschehen, die eine Materialausbreitung in südwestlicher Richtung anzeigen. Fossilreiche aussagekräftige „Fangkorb“-Bereiche haben besondere frühdiagenetische Momentaufnahmen überliefert.

Es wurden die ersten Vertebratenreste aus dem Versteinerten Wald von Chemnitz nachgewiesen – zwei Skelette eidechsenähnlicher Reptilien. Damit rückt die Vorstellung in greifbare Nähe, ein komplettes Ökosystem, einen permischen Wald samt seiner vor 290,6 (+/- 1,8) Millionen Jahren durch einen Vulkanausbruch konservierten Lebewelt zu rekonstruieren.

Symposium F – Poster

First fossil evidence of Giraffidae (Cetartiodactyla, Mammalia) from Central Europe

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Central Europe never was known as a habitat for giraffes. Although in Southern and Eastern Europe giraffe remains are recorded from the Early Miocene onwards, it seemed that they never entered Central Europe. However, this idea was questioned some years ago, when possible giraffe remains from the middle Late Miocene of Austria were discovered. Now, a recent finding definitively disabused the current opinion that giraffes generally failed to enter to central Europe. An inventory of large mammals from the Miocene of the Vienna Basin at the collection of the Natural History Museum in Vienna revealed a hemimandible with an almost complete tooth row from an early Late Miocene site.

The jaw is comparable in size to large representatives of the palaeomerycids, extinct ruminants, but the teeth differ by higher crowns. Their morphologies basically indicate a giraffe by a transitional status between brachyodont and hypsodont tooth crowns with a plesiomorph structured lingual wall of the lower molars. But they are not in agreement with any known Miocene giraffe species with their specific combination of apomorph high and slender labial stylids in common with a plesiomorph unmolarized third premolar. Consequently, the specimen is considered to represent a previously unknown species of Miocene Giraffidae.

Today, the site (Laaerberg Hill), where it was found in the 1920ies, lies in Vienna (Austria) and is stratigraphically dated as early Late Miocene (early Pannonian, MN9). That appearance datum is synchronous to the appearance datum of another large herbivore ungulate, the equid *Hippotherium primigenium*, what is used as the key species for the beginning of the Late Miocene. In Europe, *H. primigenium* heralded the time of horses with high crowned teeth suitable to masticate abrasive food items and interpreted to reflect climate/habitat changes from more closed/wet to more open/seasonally dry conditions. Although, giraffes never equal the ecological success of horses in central Europe, the changing ecological conditions at the beginning of the Late Miocene obviously were attractive to them, too, and caused migration from Spanish or Greco-Iranian or Eastern European bioprovinces.

Freie Themen – Vortrag/oral presentation

Systematic, Biostratigraphy and Paleobiogeography of Ammonoids from the Quiriquina Formation (Maastrichtian), Chile

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The Quiriquina Formation in central Chile is known for its abundant and diverse ammonite assemblage of Maastrichtian age. In the type area around Concepción Bay of central Chile we identified a total of thirty species referred to seventeen genera, one of the most diverse assemblages for the topmost Cretaceous. The presence of *Hypophylloceras* (*Neophylloceras*) *surya*, *Zelandites varuna*, *Pachydiscus* (*P.*) *jacquoti*, *Diplomoceras cylindraceum*, *Baculites anceps, Eubaculites carinatus, Hoploscaphites constrictus* and *Menuites fresvillensis* indicates a Maastrichtian age for the unit and correlates most of the sequences of the late Maastrichtian.

The following three biozones are distinguished (from base to top): Zone of *Baculites anceps*, Zone of *Eubaculites carinatus* (subdivided into the *Menuites fresvillensis* and *Kitchinites darwini* sub-biozones) and Zone without baculitids

(subdivided into the *Hoploscaphites constrictus* biozone and a zone without ammonites.

Species richness and abundance of ammonoids are high throughout the Quiriquina Formation but gradually decline in the uppermost 10 meters of the section within a unit of mottled green siltstone. No ammonites appear to be present in the last 5 meters of the unit. The assemblage shows an indopacific character but cosmopolitan, European-Tethyan and endemic faunal elements are also present.

Symposium A – Vortrag/oral presentation

Palökologische Analyse ausgewählter Schwamm-Mikroinkrustierer-Gemeinschaften aus den Cipit-Kalken der Cassian Formation (Unterkarn, Obertrias) anhand statistischer Methoden

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Die Organismen der Cassian Formation sind nur in Ansätzen erforscht, es gibt eine Vielzahl von Arbeiten über die Taxonomie und aufgrund des guten Erhaltungszustandes auch einige geochemische Studien. Nichtsdestotrotz ist über die Palökologie einzelner Organismen-Gruppen sehr wenig bekannt.

Die sogenannten. „Cipit Kalke" sind überwiegend allochton, und es ist schwierig den einzelnen „Cipit Kalken" ein ursprüngliches Milieu zu zuordenen. Sie sind reich an Mikroinkrustierern, anhand derer man bestimmte Paläomilieus diagnostizieren kann (Leinfelder et al. 1993; Schmid 1996, Flügel 2004). Aufgrund ihrer Größe sind genaue statistische Analysen möglich, vor allem Cluster-Analysen können für palökologische Studien erfolgreich angewendet werden. Die Anwendung besonderer Algorithmen hat zu hervorragenden Ergebnissen in triassischen Riff-Gemeinschaften geführt. (Schäfer 1979; Yarnell 2000). Allerdings wurden diese Methoden bisher nicht für die Analyse der Cassianer Proben angewendet.

112 Dünnschliffproben der Cipit Kalke der Lokalitäten Seelandalpe und Misurina, wurden mithilfe von Mikrofaziesanalysen quantitativ untersucht. In ihnen wurden sechs Arten von Mikroinkrustierern gefunden, welche ein diagnostiches Werkzeug repräsentieren. Die Arten sind *Koskinobullina socialis, Girvanella* sp., *Tubiphytes* cf. *obscurus, Terebella lapilloides, Reptonoditrypa cautica* und *Baccanella floriformis.*

Es wurde eine Daten-Matrix von allen Mikrofazies-Typen jedes Schliffes erstellt. Im Anschluss wurde eine Clusteranalyse. (im R-Modus mit vier Algorithmen und zwei Indices) durchgeführt. Auf diese Weise wurden drei Paare von Mikroinkrustierern bestimmt, die einen hohen Jaccard-Index besitzen und für eine enge ökologische Beziehung sprechen.

Neben der Analyse der Palökologie einzelner Mikroinkrustierer kann man dann bestimmen, ob sie zu einer paläosynökologischen Interpretation dienen können, indem man eine Q-Modus Cluster-Analyse durchführt. Wenn man die Anwesenheit von Hexactinelliden als diagnostisches Kriterium für Tiefe bzw. niedrig energetische Bedingungen auffasst, kann man sie auch als Merkmal in solchen neu erzeugten Matrizen verwenden. Damit erhält man ein Phänogramm, welches die vierzehn analysierten Gemeinschaften zeigt. Es lassen sich dabei fünf größere Organismen-Gruppen unterscheiden, die unterschiedlichen palökologischen Milieus entsprechen.

Freie Themen – Vortrag/oral presentation

Neue Ergebnisse zur Geo- und Biogeochemie ausgewählter Karbonatfazies aus der Cassian Formation

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Coralline Schwämme repräsentieren aufgrund ihrer Wachstumsformen eine hervorragende Möglichkeit, um Klimavariationen zu bestimmen (Haase-Schramm et al. 2003). Die sehr gut erhaltenen Fossilien aus der Cassian Formation (e.g. Dieci et al. 1968; Reitner 1992; Mastandrea & Russo 1995; Neuweiler & Reitner 1995) wurden daher mittels LA-ICP-MS, Elektronenmikroskopie, stabiler Isotopen- und Biomarkeranalyse geochemisch untersucht.

An drei Skeletten des Schwammes *Hispidopetra triassica* wurden $\delta^{13}C$- und $\delta^{18}O$-Werte sowie das Sr/Ca Verhältnis bestimmt. Im oberen Teil des sekundären Schwammskelettes kann man, im Gegensatz zum unteren Teil, deutliche Variationen der Isotopenwerte beobachten.

In den Schliffen sind häufig, neben den coralline Schwämmen, hexactinellide und lithistide Schwämme zu erkennen. Allerdings ergaben die Biomarkeranalysen an diesen Gesteinen bislang keine eindeutigen schwammspezifischen Verbindungen. Der Charakter des überlieferten organischen Materials wurde eher durch die mikrobiell beeinflusste Mikrobialithbildung geprägt.

Symposium F – Vortrag/oral presentation

Cannon bones – and what they can tell

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Cannon bone is another name for the metcarpal or metatarsal bone in the Equidae, Bovidae and Cervidae. In the odd-toed horses the cannon bone is the third metapodial. The third digit became dominant in the limbs very early during equid evolution and is the only digit which is used for walking in the extant genus *Equus*. In even-toed ungulates the third and fourth digits are dominant. Whereas the metacarpal/-tarsal bones are still separated in pigs they are fused together in cows and deers. Thus the cannon bone of bovids and cervids is one single bone which is formed by two bones. In the three discussed families the medial and lateral metapodials are strongly or fully reduced.

Different measurements were taken from the cannon bones of extant and fossil equids, bovids and cervids. The data from

the extant specimens were used to find a correlation between the different dimensions of the metapodials and the preferred habitat of the animals. For this investigation statistical methods like the principal component analysis were used. In another step this link between the metapodial bones and the habitat was used to assign the paleohabitat to the measured fossil ungulates. With this method the determination of the paleohabitat was possible for different Miocene fossil sites in Europe. These fossil sites are listed in the NOW database (Neogene mammals of the Old World), including the found fauna and the age in form of the biostratigraphical MN-zones (Mammals Neogene). The different habitats were mapped for different time slices and a change in the distribution of open and more closed habitats is visible. The presented approach works well for equids and bovids, but is complicated for extant and fossil cervids.

With this approach the different habitats are distinguished by the different grounds to which the long bones, especially the metapodials, are adapted. Most researchers usually use the teeth to identify paleohabitats. By comparing crown heights, enamel patterns, and/or wear facets, e.g. with the mesowear method, statements can be given to the diet of the animals, and therefore to the surrounding vegetation and the habitat. The advantage of using teeth over limb bones to identify habitats is the resistance to destruction which is much better in tooth enamel than in bone hydroxyapatite. That is one point why they are more often found in excavation sites. To use the presented method the metapodials have to be well-preserved, especially the ends.

Symposium J – Poster

Cyamodus hildegardis Peyer, 1931 (Sauropterygia: Placodontia) from the Middle Triassic of Monte San Giorgio (Ticino) – new interpretation of the postcranial skeleton

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Cyamodontoid placodonts (Eureptilia, Sauropterygia), sometimes referred to as Triassic 'reptilian rays', possess a turtle-like armour. In contrast to turtle shells, however, the cyamodontoid dermal armour is not connected to the underlying postcranial endoskeleton. In this group of marine reptiles transverse processes can be extremely enlarged, whereas ribs become increasingly reduced in size, restricted to the margins of the armour, or completely fused to the transverse processes. One of the enigmatic cyamodontoids, *Cyamodus hildegardis* from the Besano Formation (Middle Triassic) of the Alpine area of Switzerland and northern Italy, is known from both cranial and postcranial material, mainly because of the exceptional preservation conditions of fossils in the UNESCO world heritage site of Monte San Giorgio, Ticino, Switzerland.

The species has previously been reconstructed with a laterally expanded main armour shield (carapace) and a separate smaller pelvic shield, lending this species a fairly sprawling appearance. A re-examination and a literature review of the postcranial dermal armour and endoskeletal elements of the three best preserved articulated specimens of the species leads to new interpretations of the dermal armour and associated underlying postcranial bones, as well as a new life reconstruction.

The carapace of *C. hildegardis*, carrying a series of similar-sized, enlarged lateral armour plates, is rounder and less expanded than previously hypothesised. The round to ovoid main shield covers the trunk of the animal from about the first to the eleventh dorsal. The width of the main shield is basically reflected by the length of the transverse processes plus the short ribs. The separate pelvic shield, also carrying a smaller set of lateral armour plates that decrease in size with an anteroposterior gradient, covers mainly the pelvic girdle and the base of the tail. The rather short tail is armoured by four series of plates that show a simple anteroposterior gradient of size reduction in keeping with an equivalent size reduction in the caudal vertebrae. Until further fossils are recovered, the internal organisation of dermal plates within the two armour shields of *C. hildegardis* remains little known.

A comparison of the main armour among cyamodontoids revealed that *C. hildegardis* has a length-width ratio similar to the newly described cyamodontoid species from the Triassic of China rather than that of other well known European forms such as *Psephoderma alpinum* and *Henodus chelyops*. On the other hand, separate hip shields are not known from any of the Chinese specimens.

Symposium I – Poster

The hierarchical organization in biomaterials: from nanoparticles via mesocrystals to functionality

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As opposed to most human made materials, biologic structural materials employed for skeletons or teeth show a hierarchical architecture, where the components of organic macromolecules and mineral substance are inter-weaved on many length scales in order to form a composite material. In the overall skeleton the organic biopolymer fibres provide flexibility and tensile strength while the mineral provides a high elastic modulus, compressive strength, hardness and resistance to abrasion. The hierarchical composite architecture provides fracture toughness. The morphogenesis of the biomaterial as a whole and of the mineral particles is guided by the organic matrix. In this paper we use the example of rhynchonelliform brachiopods to discuss the nano- to macro-scale assemblage.

Symposium A – Vortrag/oral presentation

First evidence of aquatic spiders in the fossil record, identified with new findings of the biomimetic research

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Several recent spider species are adapted for hunting onto and below the water surface. This semi-aquatic way of life allowed them to feed on aquatic arthropods and even little fishes. The diving bell spider (*Argyroneta aquatica*) is the only spider which lives today entirely under water of clean standing water bodies. The required breathable air is stored by this species in air bubbles on water plants collected with specialised hairs on the sternum and opisthosoma. The phylogenetic status of *A. aquatica* is widely unknown because of the extreme ecological position and the unique adaptations for the life under the water surface. Because of this special lifestyle and the resulting requirements of exclusive morphological adaptations this species is also very interesting for the biomimetic research. In the fossil record there are only a few highly dubious specimens of diving bell spiders from several Neogene fossil sites (e.g. Willershausen) but only the specimens from the Late Oligocene locality of Rott (Germany) are real members of the genus *Argyroneta* according to recent analysis. Until now it was unclear if the spiders from Rott exhibiting an aquatic mode of life like the extant diving bell spider. This was only assumed by the relative numerous specimens in limnic sediments and the general similar morphology. In this study, new results of the biomimetic research, especially of the underwater air retaining superhydrophobic surfaces, were combined with the reconstructed hairiness of the 25 million year old spiders from Rott. The comparison shows that the fossils exhibit several highly similar adaptations in the location, arrangement and structure of the hairs on legs, sternum and opisthosoma so that the same aquatic mode of life could be evidenced.

Symposium B – Vortrag/oral presentation

Fossil and extant Unionidae of Southeast Asia – Species concepts and radiation patterns

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Although Southeast Asia, well known as a modern biodiversity hotspot, is inhabited by more than 100 unionid species, our knowledge on the taxonomy, biology, and evolution of the freshwater mussels from this area is still relatively poor. This is mainly due to sparse sampling and the corresponding incompleteness of morphological, anatomical, and molecular data. The initial species descriptions, mostly provided by French (Deshayes, Heude, Morelet, Morlet, Rochebrune) and American workers (Lea) in the late 19th century, were often based on limited material, and several of these species have never been re-sampled. Nevertheless, a general evolutionary pattern can be distinguished. Obviously, two separate major radiations that lead to the development of the present day diversity occurred within the two large (palaeo-) drainage areas of the region, i.e. the Yangtze and Mekong river systems. Today, these systems share only a limited number of species, and even several genera are endemic to one of these rivers.

Apart from a single, enigmatic member of the family Margaritiferidae (*Margaritifera laosensis*), all other mussel species of Southeast Asia are assigned to the Unionidae. However, the detailed phylogenetic position of most of the genera and species is still unresolved. Thus, there may be a considerable hidden diversity of freshwater mussels in that area.

In our present investigations, we apply multiple methods to address four particular topics. (1) Morphologic, anatomic, and molecular data from *Margaritifera laosensis* are combined to infer on the phylogenetic position of the species and aim at a reconstruction of the evolutionary history of the entire Margaritiferidae. Today, this family, reaching back into the Mesozoic, is dispersed over Eurasia, northern Africa, and North America with several species living in geographical isolation. (2) A morphometric approach, including Fourier shape and landmark analyses, is used to test current species level taxonomy in *Lamprotula*. This 25 species rich genus, native to the palaeo-Yangtze drainage system, can be traced back to the Late Oligocene, based on fossils from northern Vietnam. Analysing data from the type series of several extant and fossil species, the relationships among these taxa are evaluated and discussed in light of (palaeo-)geography. (3) Exemplarily, intra- and inter-population variability is addressed in the most widespread species of the genus, *Lamprotula leai*. (4) The fossil record of Unionidae from the Oligocene of Vietnam and the Pleistocene of southern China is discussed with regard to its relationship to the modern fauna, in particular to the genera *Lamprotula*, *Cuneopsis*, *Lanceolaria*, and *Hyriopsis*/*Cristaria*.

Symposium J – Vortrag/oral presentation

Patterns of ontogeny and evolution in Mesozoic amphibians

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By the early Triassic, amphibians formed essential components of aquatic faunas in rivers, ponds, marshes, freshwater lakes and coastal lagoons. In many deposits, collecting bias and taphonomic filters make the temnospondyls appear as the dominant amphibian clade, whereas little is known on the ancestors of lissamphibians at that time. The temnospondyls reached worldwide distribution and held numerous ecological niches, from 20 cm long fish eaters to 5 m long top predators. With very few exceptions, a single clade successfully survived and diversified during the Mesozoic, the stereospondyls. Unlike modern amphibians, these crocodile-like animals did not undergo major morphological changes in ontogeny. The concepts of metamorphosis, neoteny, and a larval phase, developed from the study of modern salamanders, do not apply to stereospondyls. Instead, even small juveniles looked remarkably similar to adults, and remained in the same habitats throughout their lives. The adaptive radiation of stereospondyls was triggered by their mode of ontogeny: slight variation in the timing and duration of development gave way to diverse ecomorphotypes. Analysis of these patterns reveal different evolutionary strategies by which stereospondyls managed to adapt to a broad range of habitats.

Symposium K – Vortrag/oral presentation

The Sophisticated Strategy of a Tiny Eye

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The exceptionally good preservation of phosphatised Swedish „Orsten" material from the quarry Gum (at the Kinnekülle, Västergötland, Cambrian, Series 3, *Agnostus pisiformis* zone) allows deep insights into structures of visual systems in the early fossil record. We here describe six tiny egg-shaped compound eyes representing two different ontogenetical stages, each arising from a long stalk. Though isolated from their owner, the analyis of their design uncovers the life-style of their arthropod. The visual surface of the younger specimens is covered by hexagonal facets, where even the underlying substructure can be made out. It is that of a typical apposition eye. Thus this early (probably stem-line close) crustacean may have had the mosaic-like vision comparable to most arthropods living today, such as insects or crustaceans. Because the eye is so small, a high acuity cannot be achieved, which requires small lenses, but those would not be large enough in this system to capture enough light. Using modern physiological methods it can be shown, that the eyes of the ontogenetically older stages worked sufficiently under good light conditions, which suggests a planktonic life-style in the photic zone, rather than a benthic habitat close to the muddy ground, to which the the younger stages of this sample may have belonged. Most intriguing, however, is the unique design of the ontogenetically advanced stage. While the younger eyes appear quite homogenous, here the analysis reveals four areas of different orientation and acuity, but with a balanced sensitivity over three of them. There is one area orientated backwards with a low acuity and high sensitivity, so probably orientated to investigate the dark of the dawn beyond the arthropod. The lateral side has the highest acuity possible to scan the surrounding. Almost equally acute and adapted to bright light conditions as the former, is the area to the front, which explores the wide field of view to which the animal is swimming. The most remarkable, however, is a fourth visual area orientated inwardly. If the contralateral eye is taken to consideration, it can be shown that the optical axes of both eyes intersect widely in the front and especially the contralateral sides. These intersections form rhomboid informational units and cover a wide field of stereoscopic vision, while its acuity can be changed by moving the stalks.

Most fascinatingly, here we have a new and effective principle of vision. The acuity of this compound eye, compared to ours, is very low, because of the low number of pixels in the visual mosaic If, however, a tiny object is moving in this three dimensional field of view from one rhomboid to the next, it would be detected by a different pair of facets each time, as in a coordinate system. Size, velocity or distance of the moving object can be estimated. Thus, despite its small size and limited equipment the sophisticated strategy of this eye may have enabled an active predatory life-style. Not to have used it in this way, would have been a waste of energy.

Symposium K – Poster

Neue Einblicke in das visuelle System alter Augen – Die Augen von Phacopiden (Trilobita)

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Es gibt zwei Grundprinzipien visueller Systeme moderner Invertebatenaugen. Das eine besteht aus einer kleinen Retina, die mehr oder weniger dicht unter einer Linse liegt; in dem anderen wird das einfallende Licht auf eine lichtleiterartige Struktur, das Rhabdom, fokussiert. Viele solcher Einheiten (Ommatidien) liefern ein mosaikartiges Bild, wie wir es von heutigen Insekten oder Krebstieren kennen. Bei heutigen aquatischen Arthropoden gibt es eine Reihe hochspezialisierter Ausformungen dieses Prinzips, um sich an die ggf. reduzierten Lichtbedingungen unter Wasser zu adaptieren.

Bis jetzt aber gibt es kaum Vorstellungen über fossile visuelle Designs. Micro-ct jedoch erlaubt erste Einsichten, wie die Komplexaugen von Trilobiten, hier im Speziellen Phacopiden, strukturiert gewesen sein könnten, was auch erste Annahmen über ihre Funktion erlaubt.

Symposium B – Poster

Rein in den Fluss, raus aus dem Fluss: Die Mollusken der Koobi Fora Formation des Turkana Beckens, N-Kenia

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Das Turkana-Becken im Norden Kenias und Süden Äthiopiens ist für seine bedeutenden Funde von Hominiden bekannt. Daneben sind Süßwassermollusken in großer Zahl und in ungewöhnlich guter Erhaltung in vielen Schichten über die gesamte Abfolge der Koobi Fora Formation zu finden. In der Vergangenheit wurde bereits versucht, diese Mollusken für biostratigraphische Zwecke und evolutionsbiologische Fragestellungen zu nutzen. So diente die Abfolge der Mollusken als Beleg für Artbildungsprozesse und die Hypothese vom unterbrochenen Gleichgewicht („punctuated equilibrium"), was in den 1980er Jahren für Diskussion sorgte. Weitere und neue Arbeiten basierend auf den Mollusken des Turkana-Beckens wurden aber nicht vorgelegt, um die offenen Fragen zu klären. Im Rahmen einer vollständigen Neubearbeitung der gesamten Molluskenfauna basierend auf eigenen Aufsammlungen wird die Entwicklung des Turkana Beckens zwischen dem Pliozän und Pleistozän rekonstruiert. Im Moment liegt der Fokus auf den Ablagerungen des Lorenyang Sees mit einem Alter zwischen etwa 2,0 und 1,6 Millionen Jahren.

Die quantitative Auswertung der stratigraphischen Verbreitung der wichtigsten und häufigsten Molluskenarten zeigt deutliche Veränderungen der Faunenzusammensetzung im Laufe der Zeit in einem eng begrenzten Gebiet (Area 102). Im unteren Teil des „Upper Burgi Members" bis zum Leithorizont C2 sind v.a. Muscheln der Gattung *Pseudobovaria* sehr häufig, ebenso *Coelatura bakeri*. Oberhalb des Leithorizontes C2 bis zum Leithorizont C3 dominiert *Cleopatra bulimoides* in verschiedenen Morphotypen. *Melanoides tuberculata*, eine ebenfalls häufige Schneckenart, liegt in diesem Abschnitt der Koobi Fora Formation in miniaturisierten Formen mit nadeligen Schalen vor. Gleichzeitig mit *M. tuberculata* ändert auch *Pseudobovaria* sp. die Schalenmorphologie von glattschalig-trigonal zu knotig-elongat. Daneben gibt es einige Molluskenarten, die auf das C2-C3-Intervall beschränkt sind: *Coelatura aegyptiaca, Valvata* sp. und *Bulinus* sp. Oberhalb von C3 dominiert *Melanoides tuberculata* mehr und mehr, anfangs noch als miniaturisierte Form, im KBS Member oberhalb von C4 dann wieder in normaler Ausprägung. Auch *Pseudobovaria* sp. kehrt zur glattschalig-trigonalen Morphologie zurück. *C. bakeri* ist in diesem Abschnitt der Koobi Fora Formation auch wieder regelmäßig zu finden und in einigen Schalenlagen sehr häufig. Auffällig ist die Verbreitung von *Bellamya unicolor*. Diese Art ist nur in wenigen isolierten Sandsteinlagen häufig zu finden, dann aber auch gesteinsbildend.

Die beschriebenen Verbreitungs- und Abundanzmuster werden, so unsere These, durch ökologische Prozesse gesteuert, etwa im C2-C3 Intervall durch den Einfluss eines Flussdeltasystems in Area 102. Das zeigt sich auch an der Fazies der Sedimente. Durch den Aufbau des Deltas verschwinden ehemals stabile lakustrine Habitate und werden durch temporäre Habitate im Einzugsbereich des Deltas ersetzt. Die Mollusken reagieren entweder mit morphologischen Änderungen oder werden aus dem Gebiet verdrängt und werden erst mit einer Stabilisierung der ökologischen Rahmenbedingungen wieder häufiger. Über den Fluss gelangen auch neue Arten in den See, die als Flussarten auf die Deltahabitate beschränkt bleiben und mit dem Verschwinden des Deltas aus Area 102 ebenfalls erlöschen. Hinweise auf eine tatsächlich adaptive Radiation der Mollusken in diesem Zeitabschnitt lassen sich dagegen nicht finden. Weitere paläontologische, sedimentologische, geochemische und zoologische Untersuchungen laufen, deren Ergebnisse zur Rekonstruktion der Entwicklung des Turkana Beckens in einer wichtigen Phase der Hominidenevolution beitragen werden.

Symposium D – Vortrag/oral presentation

Palaeobotanical and palynological studies in the Cretaceous of the Negev Desert, Israel

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In the central and northern Negev Desert exposures of Cretaceous sediments can be found in three erosional cirques, anticlines or „craters", namely Makhtesh Ramon, Makhtesh Hatira (= M. Ha Gadol) and Makhtesh Qatan (= M. Hazera). The focus of the present paper will be the palynology and palaeobotany of the mainly siliciclastic, non-marine Hatira Formation of Aptian-Albian age which is overlain by the predominantly carbonatic marine Hevyon Formation of late Albian to early Cenomanian age.

Among the most characteristic and common macrofloral elements in the Hatira Formation are wood and leaf material of the widespread Early Cretaceous fern *Weichselia*. In the Albian of Makhtesh Ramon it is part of a coastal flora of 25 species of ferns, ginkgophytes, conifers and angiosperms. Recent discoveries of fossil plant localities in the upper Hatira Formation of Makhtesh Qatan provide new insights into the composition and palaeoecological siginificance of regional Albian floras. Plant remains from the locality IQ1, an intercalation of dark grey shales in the sandstones of the Hatira Formation, are special in a local context in that organic material such as cuticles and palynomorphs are preserved. Palynofloras from locality IQ1 are overwhelmingly dominated by pteridophytic spores, mainly psilate, trilete forms including *Diytophyllidites*, a spore

type also found in situ in synangia of the fern *Weichselia*. In situ spores of *Weichselia* are also known from the Albian of Makhtesh Ramon, but in this case preserved as moulds without any organic material left. The pteridophyte dominance of the IQ1 microflora is in contrast to gymnosperm dominance of the associated macroflora which yielded leaves and cataphylls of a new gymnosperm genus of supposedly gnetophytic affinity as most abundant forms. Gymnosperm pollen is relatively uncommon and includes members of the Araucariaceae (*Araucariacites/Inaperturopollenites*: 2-4%), Cheirolepidiaceae (*Classopollis*: 0-1%), Cycadales (*Eucomiidites*: 0-0.4%) and Ephedrales (*Ephedripites*: out of count). Angiosperm and angiosperm-like pollen is a surprisingly scarce element (0.5% or less) and includes *Clavatipollenites*, *Pennipollis*, *Retimonocolpites*, *Afropollis*, *Tricolpites*, *Rousea* and the winteraceous pollen tetrad *Walkeripollis*. This assemblage is consistent with an early to middle Albian age of the IQ1 flora taking into account the absences of typical late Albian to early Cenomanian pollen grains such as *Elaterosporites* which have been found in the Hevyon Formation overlying the Hatira Formation.

Freie Themen – Vortrag/oral presentation

Occlusal surface analysis of dryolestoid molars (Mammalia, Cladotheria)

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The mesio-distally compressed and linguo-buccally widened form of „trigon" and trigonid of the pretribosphenic dryolestoid molars is crucial for the embrasure shearing process as the lower molars fit into the embrasures between the upper molars during occlusion. The reversed triangular pattern of trigon and „trigonid" is shared with the more plesiomorphic symmetrodontans (Spalacotheriida). The three main cusps of the trigonid and the sharp leading edges have mainly puncture-crushing function for opening hard exoskeletons of insects. An addition dryolestoids evolved accessory shearing surfaces, mesial to the trigon and distal to the trigonid for further processing of softer food items. The lower molars show a unicuspid talonid (hypoconulid) disto-lingual to the trigonid, the upper molars a parastyle mesial to the „trigon". The buccally oriented guiding groove of the unicuspid talonid is homologous to the hypoflexid of the tribosphenic molar. However, in tribosphenic molars the hypoflexid is more steeply inclined and less involved in occlusal contacts. Striation analysis and virtual simulation of the relative movements of the molars using the newly developed „Occlusal Fingerprint Analysis"-software demonstrate a functional difference of the dryolestid and the tribosphenic hypoflexid. In the dryolestid hypoflexid, shearing is the important function during the chewing cycle, when the paracone slides buccally along the guiding groove. The average angle of the striations related to the occlusal plane is steeper than the inclination of the guiding groove in the hypoflexid. This indicates that the lower molar moves in two phases into occlusion during the chewing cycle: an initial puncture-crushing phase and a subsequent shearing phase before full centric occlusion. A typical tribosphenic grinding phase after centric occlusion does not occur in dryolestids. During the evolution of the talonid basin, the shearing area of the hypoflexid was displaced buccally and rotated in mesial direction. In combination with the formation of the talonid basin a functional shift in the chewing cycle from shearing to grinding occurred and the hypoflexid lost its function as a main shearing area.

Freie Themen – Vortrag/oral presentation

Die Plattenkalk-Becken in der südlichen Frankenalb (Bayern, Süddeutschland) als Ursprungszentren neuer Fischgruppen

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Die Plattenkalk-Becken in der südlichen Frankenalb des Oberjuras zeigen eine unterschiedliche Zusammensetzung der Fischfaunen regional und zeitlich. Die Untersuchung der Fischfaunen ausgewählter Becken (z.B. Ettling, Daiting, Schamhaupten, Solnhofen) ergab folgende Gemeinsamkeiten: 1. Die am häufigsten auftretende Gruppe in Anzahl an Arten als auch in Anzahl an Individuen sind die Teleostomorpha, und vor allem echte Teleosteer. 2. Die Taxonomie der meisten Fische ist nur unvollkommen bekannt. Dennoch die wenigen, gut identizierbaren Taxa zeigen zeitliche und räumliche Unterschiede. 3. Die Kenntnis vieler Fundorte ist unvollständig, belegt immer wieder durch die Entdeckung neuer Arten.

Die am besten untersuchte Fischgruppe der Plattenkalke sind die echten Teleosteer. Die Teleosteer sind durch heute ausgestorbene Linien wie basale Vertreter (*Tharsis* und Ichthyodectiforme) und durch basale Vertreter der Kronengruppe Teleostei (Elopiformes, Ostariophysi, Euteleostei) vertreten. Unsere Untersuchungen zeigen, dass einige wenige Arten wie *Tharsis dubius* und *Leptolepides sprattiformis* vom Kimmeridgium zum oberen Tithonium durchgehen und eine weite Verbreitung haben. Beide Arten zeigen morphologische Änderungen in der Zeit, diese sind aber so geringfügig, dass nicht zu entscheiden ist, ob diese Änderungen nur Variationen (bisherige Annahme) oder neue Arten kennzeichnen. Dagegen treten andere Arten wie *Orthogonikleithrus leichi* und *O. hoelli* sehr lokal auf, auch sind sie zeitlich sehr begrenzt, aber sie sind die ersten Vertreter einer sehr erfolgreichen Linie der Kronengruppe der Teleostei, der Euteleostei. Andere Formen wie die Elopiformen (z.B. *Anaethalion, Elopsomolos*) hatten in den Plattenkalk-Becken des Oberen Jura ihre größte Radiation, während heute nur noch wenige Vertreter überlebten.

Die eingehende Untersuchung von Exemplaren einer Art eines speziellen Beckens und der Vergleich mit ähnlichen Formen anderer Becken und anderer Zeitniveaus erlaubt es uns die Variabilität eines Taxons und die Änderung in der Zeit zu bestimmen. Die Plattenkalk-Becken bieten diese Möglichkeit, allerdings ist für diese Untersuchungen eine genaue Altersbestimmung der Fundorte wichtig.

Symposium I – Vortrag/oral presentation

Texture and microstructure of otoliths from cave- and surface-dwelling fish: a high-resolution EBSD study

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Unlike other studied biomineralisates such as shell, teeth or bone, otoliths are not optimized for mechanical loads but serve the senses of hearing and balance in fishes. Thus, better knowledge of the internal structure of otoliths may provide deeper insights into basic similarities and structural principles of biomineralisates in general. Otoliths of modern bony fishes (teleosts) are massive polycrystalline structures consisting of 90-99% of calcium carbonate, mainly aragonite (occasionally some vaterite) and up to 10% of organic material (Borelli et al. 2003; Murayama et al. 2002). Previous studies on the otoliths of several surface populations and the cave form of the Atlantic molly (*Poecilia mexicana*) revealed pronounced differences in the morphology of the surface structure of otoliths between these two ecotypes (Schulz-Mirbach et al. 2008). In order to highlight internal structural variations within one otolith as well as between otoliths derived from cave and surface fish, we performed microstructural and textural analyses applying the EBSD technique on sagittal sections of otoliths. Since aragonite crystal sizes are very small and their accumulation is little structured, EBSD analyses had to be conducted with a high spatial resolution. So far, we found slight differences in the orientation of crystallites at the margins of otoliths whereas in the centre of otoliths no preferred orientation of crystallites could be identified. More detailed and extensive analyses with focus on potential differences of the internal structure of otoliths between cave and surface fish are in progress.

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Schulz-Mirbach, T., Stransky, C., Schlickeisen, J. & Reichenbacher, B. (2008): Differences in otolith morphologies between surface- and cave-dwelling populations of *Poecilia mexicana* (Teleostei, Poeciliidae) reflect adaptations to life in an extreme habitat. – Evol. Ecol. Res. 10: 537–558.

Freie Themen – Poster

3D analysis of the inner ear in the Oligocene fossil ground squirrel *Heteroxerus costatus* (Rodentia, Mammalia)

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Almost 50% of recent mammals are represented by rodents. One of the most basal groups are the Sciuromorpha, which are divided extant in Aplodontidae (Mountain beavers), Sciuridae (Squirrels) and Gliridae (Dormice). They spread around the world, by occupying different habitats and showing different types of locomotion. The starting point of this functional morphological study in Sciuromorpha, is the well preserved fossil rodent skull of *Heteroxerus costatus.* This fossil ground squirrel from the Upper Oligocene of Gaimersheim (MN 28), Southern Germany, was investigated by high-resolution computed tomography (MicroCT). The collected and reconstructed data are compared with results of further recent Sciuromorpha, representing different locomotion types (arboreal, gliding, fossorial, generalistic). The first part of this study is focussing on the middle and inner ear and their significance for functional morphological conclusions in fossil squirrels. The middle ear ossicles of *Heteroxerus* resemble the general morphology observed in our investigated extant sciuroids, for example *Sciurus vulgaris*. A secondary crus commune can be observed in all investigated taxa, which is regarded as plesiomorphic and exhibits a groundplan character. The number of cochlea turns differ considerably; while *Heteroxerus* has 2.5 turns, extant fossorial sciurid species have almost 3.5 turns. Adaptations to locomotion and posture can be deduced from the morphometry of the semicircular canals of the bony labyrinth (width, height and length of the canals) especially in the lateral canals. Morphological regression analyses show a similarity in *Heteroxerus costatus* and *Spermophilus citellus*. The morphology in a fossil specimen of *Spermophilus undulatus* is quite different. Based on the morphometry of the semicircular canals, the locomotory behaviour of *Heteroxerus* can be assumed as fossorial, a specialization for living on the ground.

Abstract **Schwarz-Wings & Fritsch**, siehe S. 109

Freie Themen – Vortrag/oral presentation

Die Krebsfauna der oberjurassischen Plattenkalke von Wattendorf (Ober-Kimmeridgium, Nördliche Frankenalb)

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In Süddeutschland kommen fossilführende oberjurassische Plattenkalke speziell in der Region um Solnhofen and Eichstätt vor. Sie haben ein Unter-Tithonium-Alter und wurden vor allem aufgrund ihrer Wirbeltierreste (*Archaeopteryx*, Flugsaurier, Fische, etc.) weltberühmt, führen aber auch eine reiche und gut erhaltene Krebsfauna. Vor wenigen Jahren wurde im nördlichsten Teil der Frankenalb ein neues Plattenkalk-Vorkommen entdeckt. Es ist in einem großen kommerziellen Steinbruch aufgeschlossen und wird seit 2004 von einem Team des Naturkunde-Museums Bamberg und Paläontologen der Universitiäten von Erlangen und München in jährlichen Grabungskampagnen systematisch erforscht. Dieses Plattenkalk-Vorkommen von Wattendorf ist nach der seiner Ammonitenfauna (u.a. *Aulacostephanus eudoxus*) dem Ober-Kimmeridgium zuzurechnen (zeitliches Äquivalent der französischen Eudoxus-Zone). Damit stellt es den ältesten oberjurassischen Plattenkalk überhaupt dar. Die fossilführenden Schichten befinden sich in der Nähe eines stark dolomitisierten Riffkomplexes, dem sie sich in dessen unmittelbarer Nähe steil anlagern; zum Teil findet auch eine Verzahnung mit dem Dolomit statt. Die meisten der geborgenen Fossilien stammen aus einem nur 15 cm mächtigen Gesteinspaket, einige auch aus riffnahen, dolomitisierten Laminiten, die aus technischen Gründen nicht systematisch beprobt werden können. Ein hoher Faunenanteil gehört zum Benthos (z.B. Seeigel, Brachiopoden, Gastropoden, Muscheln) und lässt sich aus den benachbarten Riffbiotopen herleiten. Decapoden sind recht häufig und vorwiegend durch Exuvien repräsentiert. Die folgenden Taxa wurden nachgewiesen:

„Natantia“: *Aeger elegans* Münster, *Aeger tipularius* (Schlotheim), *Antrimpos* sp., *Bylgia ruedeli* Schweigert & Garassino, *Dusa monocera* Münster, *Dusa araneae* Schweigert, *Hefriga* sp. (Jugendexemplare), *Koelga curvirostris* Münster.

„Reptantia“: *Cycleryon propinqus* (Schlotheim) (einschließlich *C. spinimanus* [Germar]), *Cycleryon orbiculatus* (Münster), *Eryon arctiformis* (Schlotheim), *Galicia* cf. *veltheimii* (Münster), *Glyphea tenuis* Oppel, *Palaeastacus fuciformis* (Schlotheim), *Palinurina longipes* Münster.

Die Eryoniden scheinen in den dolomitisierten, riffnahen Laminiten häufiger zu sein als in den eigentlichen Plattenkalken. Trotz der Nachbarschaft des Riffs fehlen Brachyuren (z.B. Prosopiden) und Anomuren (z.B. Galatheiden) vollständig, obwohl oberjurassische Schwamm- und Korallenriffe diese Krebsgruppen nachweislich artenreich enthalten. Dies ist vermutlich sowohl auf diagenetische Gründe (geringes Erhaltungspotential aufgrund schwacher Sklerotisierung) als auch auf Grenzen beim Aufsammeln zurückzuführen. Viele Fossilien sind nämlich von einer Kalklage überdeckt und bei geringem Relief praktisch nicht erkennbar. Im Gegensatz dazu kommen gelegentlich isolierte Scheren von Einsiedlerkrebsen (*Goniochirus* sp.) vor. Letztere bewohnten vermutlich die leeren Gehäuse von Gastropoden oder Ammoniten. Einige – allerdings nicht alle – der nachgewiesenen Decapoden-Taxa zeigen geringfügige Unterschiede zu den verwandten Formen aus den tithonischen Solnhofener Plattenkalken. Dies dürfte im Altersunterschied der Faunen begründet sein. Neben den genannten Decapoden (darunter *Phyllosoma*-Larven von *Palinurina*) kommen auch Glaskrebs-Verwandte (*Elder ungulatus* Münster), Stomatopoden (*Sculda* sp.) und Isopoden vor.

Freie Themen – Poster

Vorschlag zum Fossil des Jahres 2011: Feder aus dem Nusplinger Plattenkalk

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Als im Jahr 1859 Charles Darwins epochales Werk „On the Origin of Species“ erschien, kam nur zwei Jahre später im oberjurassischen Solnhofener Plattenkalk in Bayern eine ganz modern anmutende Vogelfeder zum Vorschein, und noch im selben Jahr folgte der erste Skelettfund eines befiederten Reptils, das als Urvogel *Archaeopteryx* zu einem der wohl weltweit berühmtesten Fossilien wurde. Mittlerweile sind die Reste von neun weiteren Skelettfunden von Urvögeln aus dem Solnhofener Plattenkalk publik geworden, jedoch keine Einzelfeder mehr – trotz der intensiven Sammeltätigkeit Tausender.

Mitte Mai 2009 wurde jetzt bei der wissenschaftlichen Grabung des Stuttgarter Naturkundemuseums im Nusplinger Plattenkalk (westliche Schwäbische Alb) ebenfalls eine versteinerte Feder gefunden. Die im Schwäbischen Jura einzigartige Fundstelle genießt schon seit Jahrzehnten gesetzlichen Grabungsschutz und wird seit 1993 wissenschaftlich untersucht. Über 350 verschiedene Arten jurazeitlicher Tiere und Pflanzen – vom Einzeller bis zu Zähnen und Skelettresten meterlanger Meereskrokodile – können wir mittlerweile in dieser Lagunenablagerung belegen. Bei ca. 20-25 Grabungstagen pro Jahr kommen noch immer völlig neue oder zumindest für dieses Vorkommen neue Nachweise zum Vorschein und liefern zusammen mit Daten aus anderen Disziplinen Puzzlestein für Puzzlestein zu einem immer lebendigeren Bild der Oberjurazeit. Trotz der Sorgfalt beim Abbau der feinschichtigen Kalkplatten war der Federfund ein glücklicher Zufall.

Die Feder aus Nusplingen ist nur 8 Millimeter lang, aber ähnlich wie der Solnhofener Fund von 1861 in organischer Substanz erhalten. Auffällig ist ihr extrem breiter Schaft. Die Fahne besteht aus sehr feinen Federästen, die in einer Ebene angeordnet und zumindest im proximalen Bereich miteinander verhakt sind. Der Form nach handelt es sich weder um eine typische Konturfeder noch um eine Daunenfeder. Ob die Feder von *Archaeopteryx* oder einem noch unbekannten befiederten Dinosaurier stammt, vermag man noch nicht zu sagen, weil bisher weltweit noch kein vergleichbarer Fund bekannt ist. Da der Nusplinger Plattenkalk nach der darin enthaltenen Ammonitenfauna etwa 0,5 Millionen Jahre älter ist als derjenige von Solnhofen, stellt der Neufund eine der derzeit weltweit ältesten

Federn dar. Einige Funde befiederter Dinosaurier aus China (*Pedopenna daohugouensis*, *Epidexipteryx hui*, *Anchiornis huxleyi*) sollen zwar noch älter sein, doch ist deren Datierung noch umstritten.

Die Nusplinger Feder bezeugt das Vorhandensein befiederter Tiere zur damaligen Zeit in Südwestdeutschland. Sie lebten vermutlich ebenso wie einige Flugsaurier, Insekten und Landpflanzen auf den Inseln, die die Nusplinger Lagune umgaben. Vermutlich gelangten die Landtiere über eine Art „Inselhüpfen" in diese Region. Theoretisch existiert also tatsächlich die Chance, in Zukunft irgendwann auch noch das zur Feder gehörende Tier zu finden.

Freie Themen – Poster

Ein neuer Plesiosauride aus dem Unteren Lias (Pliensbachium) von Sommersell (Kreis Höxter), Nordrhein-Westfalen, Deutschland

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Im Juni 2007 wurde in der Ziegelei-Tongrube Lücking in Sommersell, Kreis Höxter, Nordrhein-Westfalen, das teilartikulierte Skelett eines Plesiosauriers in den Schichten des unteren Pliensbachiums entdeckt und anschließend vom Westfälischen Museum für Naturkunde in Münster geborgen und präpariert. Damit befindet sich der Fund stratigraphisch zwischen bekannten Taxa aus dem Hettangium und Sinemurium Englands und dem Toarcium Süddeutschlands und Englands.

Der Schädel und die distalen Elemente der Extremitäten sind nicht überliefert, während der Großteil des Axialskeletts vorhanden ist. Insgesamt liegen 78 Wirbel, Schulter- und Beckengürtel, sowie die proximalen Elemente der Vorder- und Hinterextremität (Humerus, Radius, Ulna / Femur, Tibia, Fibula) vor. Carpalia, Tarsalia und Phalangen befinden sich verstreut auf der Gesteinsplatte. Parallel zu der osteologischen Bearbeitung des Individuums wurde der Vergleich mit bekannten, vor allem unterjurassischen Taxa in der Literatur und mit Sammlungsmaterial des Natural History Museum in London und des Staatlichen Museums für Naturkunde in Stuttgart durchgeführt. Einige Merkmale unterscheiden das Taxon aus Sommersell eindeutig von bestehenden Taxa.

Nach dem osteologischen Vergleich wurde die Eigenständigkeit des Fundes aus Sommersell zusätzlich durch eine phylogenetische Analyse überprüft, wobei der Fund zu dem Datensatz von Ketchum & Benson (2010) hinzugefügt wurde. Das Ergebnis bestätigte die bei der osteologischen Beschreibung entstandene Vermutung und zeigt deutlich, dass es sich um ein neues Taxon handelt, dass sich durch drei Autapomorphien und die Kombination von insgesamt sieben eindeutigen („*unambiguous*") Synapomorphien begründet. Er steht gemeinsam mit *Plesiosaurus dolichodeirus*, *Seeleyosaurus guelmiimperatoris*, *Microcleidus homalospondylus*, *Occitanosaurus tournemirensis* und *Hydrorion brachypterygius* innerhalb der monophyletischen Gruppe der Plesiosauridae. Die stratigraphische und paläogeographische Lage des Fundes unterstützen dieses Ergebnis ebenfalls. Auf der Grundlage der Ergebnisse der phylogenetischen Analyse werden eine neue Gattung und eine neue Art für das Taxon aus Sommersell errichtet.

Symposium K – Keynote

Cambrian Explosion and Ordovician Biodiversification or Cambrian Biodiversification and Ordovician Explosion?

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Besides the terms „Cambrian Explosion" and „Cambrian Substrate Revolution", the term „Great Ordovician Biodiversification Event" has recently been introduced to designate the most important increase of biodiversity of marine life during Earth's history. While a high number of scientists focused research on the so-called 'Cambrian Explosion', only few workers concentrated research on the Ordovician radiation of marine invertebrates. The „Cambrian Explosion" (some 545 to 530 Ma ago) resulted in a series of spectacular findings of 'new' animals that mostly come from famous Fossil-Lagerstätten such as the Burgess Shale or Chengjiang. These Konservat-Lagerstätten might be considered taphonomic windows that allow a view to the „new" Cambrian animals. For the first time, most animal phyla became „visible", although molecular-clock data suggest that these lineages split some 800 Ma or more before their appearance in the fossil record. As such, the „Cambrian Explosion" involved the origins of skeletalisation and a range of new body plans, and is considered a major event in Earth's history. Some 40 to 80 Ma after the „Cambrian Explosion", the diversity of the new phyla quantitatively „exploded" during the Lower and Middle Ordovician (485 to 460 Ma ago). This Ordovician Biodiversification generated few new higher taxa, but witnessed a staggering increase in biodiversity at the family, genus and species levels, documented in all diversity counts. The „Great Ordovician Biodiversification Event" should therefore be considered to be an „explosion of diversity" and a term such as „Ordovician Explosion" of diversity would be justified. The Ordovician Biodiversification had probably (Pre-) Cambrian roots, and was probably a follow up of the Cambrian Explosion. Both events seem indeed to be linked and are possibly belonging to a single large-scale evolution, because the two most significant geological triggers, the changing paleogeography and the changing paleoclimate, are long ranging factors.

Abstract **Schwermann & Martin**, siehe S. 110

Symposium B – Vortrag/oral presentation

Cameral deposits in a sublethally damaged Carboniferous orthoconic nautiloid from the Buckhorn Asphalt *Lagerstätte* in Oklahoma, USA

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The recovery of a partially complete specimen of ?*Pseudorthoceras* sp. from the Buckhorn asphalt deposit with its exceptionally preserved aragonite shell and mineralised internal structures provides new insight into the controversy over how cameral deposits are developed in some orthoconic nautiloids. The specimen consists of two chambers of the phragmocone that exhibit two oval openings on opposite sides of the external shell. The openings are interpreted as the result of a piscatorial predator attack that damaged the outer phragmocone shell and penetrated the existing cameral deposits. Both the outer test and the initial cameral deposits were penetrated.

An analysis of the specimen shows the damage must have occurred early in the growth of the animal because in both chambers the deposits adjacent to the shell walls are relatively thin and normal in appearance. The attack apparently did not kill the cephalopod because after the attack it developed abnormal cameral deposits on top of the normal deposits. The openings in the two chambers to the external environment must have produced a major change in the cameral fluid chemistry by the addition of marine water. Despite this chemical change, cameral deposits continued to be laid down at the same places as the original deposits.

With this information, three hypotheses of cameral deposit precipitation can be tested. Briefly, these hypotheses are: 1) direct precipitation from the cameral fluid as fluid is removed by the siphuncle, 2) precipitation from the cameral fluid with a reoccurring organic template or membrane, and 3) secretion by a cameral tissue inside the chamber. Neither hypotheses one or two can be supported because the precipitation chemistry of the cameral fluid is altered and cannot be controlled with the influx of marine water. Thus, these two hypotheses must be rejected. The third hypothesis remains possible with the penetration holes being sealed by cameral tissue regeneration. In this case, cameral fluid chemistry would not be important for cameral deposit precipitation. However, previously established arguments against this hypothesis still stand, as there are no known tissue connections from the siphuncle through the connecting ring to the cameral chamber. Thus, none of the currently proposed hypotheses seem to explain the sequence of deposition of the cameral deposits seen in the specimen of ?*Pseudorthoceras*, and therefore, this biological question still remains unresolved.

Symposium B – Poster

Primary *versus* diagenetic isotope signals in *Pseudorthoceras* sp. from the Buckhorn Asphalt Quarry (Mid-Pennsylvanian, Oklahoma) – a detailed study of cameral deposits

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Oxygen and carbon stable isotope studies of well-preserved fossils present an important data source for palaeoclimatic studies. Commonly, the older the fossils, the less good they are preserved. The Buckhorn Asphalt Quarry Lagerstätte from the Mid-Pennsylvanian of Oklahoma is one of the few Palaeozoic examples, where original (metastable) shell material, such as aragonite and high magnesium calcite (HMC) is found, due to their early post-mortal hydrocarbon impregnation. The Buckhorn Asphalt Quarry is characterised by fossiliferous sediments soaked with hydrocarbons, which commonly prevented diagenesis.

This study presents microstructural, mineralogical and stable isotope data from *Pseudorthoceras* sp. (two chambers with their cameral deposits). Therefore data from thin section analysis, Scanning Electron Microscope (SEM) combined with an Energy Disperse X-ray (EDX), and X-ray Diffraction (XRD) with a General Area Detection Diffraction System (GADDS) analysis were combined. XRD-GADDS is a relatively new method to investigate the shells mineralogy and allows the non-destructive, site-specific identification of mineral phases.

Altogether seven microstructures were differed in the sections drilled for isotope dating. These could be divided into two primary mineralogies, aragonite and HMC. We don't have any knowledge of cameral deposits with a HMC mineralogy or found any evidence of this in literature. The only partially unaltered preserved microstructure is the nacre of the septum. All other microstructures exhibit a partial or complete alteration to low magnesium calcite (LMC), or in case of the primary HMC to LMC and dolomite. According to the isotope signature the diagenesis took place most likely in the meteoric environment. The partial diagenesis results in isotope values, which plot along a linear trend between the two end-members. This linear trend could easily be misinterpreted as kinetic vital effect, if no sorrow phase control was performed. The isotopic signal of the primary nacre of the septum suggest a normal marine environment for these nektonic molluscs, with tropical temperatures of 14°C to 15°C ($\delta^{18}O_{seawater}$ 1.5 ‰, a typical value for modern tropical marginal seas).

Freie Themen – Vortrag/oral presentation

Probleme und Hypothesen zur Evolution der Sphenacodontia (Synapsida)

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Der jüngst vorgestellte Fund des ältesten Therapsiden *Raranimus* stellt eine zeitliche und sehr gute morphologische Verbindung zu Befunden prä-therapsider Sphenacodontia her. Kladistische Analysen stellen Therapsida und Sphenacodontidae als Schwestergruppen heraus, mit *Haptodus* als Außengruppe. Zwischenzeitlich zu *Haptodus* gestellte Gattungen gelten inzwischen als valid und werden als Paraphylum aufgefasst. Eine stratigrafisch gebundene Darstellung dieses Stammbaums ergibt zunächst eine verbesserte Kenntnis der Evolution, indem *Haptodus*, *Dimetrodon* + *Tetraceratops*, *Raranimus* und weitere Therapsiden in zeitlicher Folge auftreten. Erweitert man jedoch das Modell um die Validität mehrerer haptodontiner Taxa und um die stratigrafische Verteilung aller Sphenacodontidae, so ergibt sich: 1. Die Haptodontinae treten vom frühen Stephan bis ins höhere Rotliegend auf (*Palaeohatteria* und Autun-Funde). Sie erscheinen als eigene Entwicklungslinie mit teils sehr fortschrittlichen Merkmalen (*Pantelosaurus*, um die Stephan-Rotliegend-Grenze). 2. Sphenacodontidae treten spätestens im späten Stephan auf (ein Kieferrest aus dem Saar-Nahe-Becken, dazu *Macromerion*), sogar mit klassischen Perm-Taxa (*Sphenacodon*, *Dimetrodon*). 3. Das daraus resultierende Problem ist die Rückdatierung der phylogenetischen Trennung von Therapsida und Sphenacodontidae mindestens ins späte Stephan. 4. Die Höherentwicklung unter Haptodontinae kann nicht als Vorstufe der Sphenacodontoidea gelten. Fazit: Das vermeintliche missing link *Raranimus* erzeugt noch längere ghost lineages als allein unter prä-therapsiden Taxa, nämlich von etwa 30 Ma. Komplizierter wird der Fall noch an *Tetraceratops* mit therapsiden Merkmalen. Diese dürften Konvergenzen sein, da Plesiomorphien auf einen haptodonten Status hinweisen. Die sehr weitgehende Hypothese besteht nun darin, Therapsiden aus einem haptodonten Stadium abzuleiten. Dabei repräsentiert *Tetraceratops* ein (sicherlich autapomorph spezialisiertes) Zwischenstadium. Die zeitliche Lücke zu *Raranimus* wäre damit erheblich kürzer und unproblematischer. Sphenacodontidae erscheinen nach diesem Modell als Abkömmlinge früher Haptodonten, die bis zu ihrem Erlöschen im höheren Rotliegend ökologisch dominierten. Ihre Höherentwicklung wäre demnach eine Parallelentwicklung zu den Haptodontinae, was durch gleiche evolutionäre Voraussetzungen möglich ist. Die ökologische Geschichte kann das Erlöschen der erfolgreichen Sphenacodontiden mit dem Aufblühen der Therapsiden verbinden, zunächst ohne Ursache und Wirkung zu bestimmen. Insgesamt problematisch ist die Untermauerung, die noch umfangreiche morphologische und kladistische Untersuchungen abwarten muss, dazu Analysen bezüglich des metabolischen Status‘ früher Synapsiden. Derartige Projekte sind in Planung.

Freie Themen – Poster

Morphological differentiation of geographically separated populations of Arabian Killifish, *Aphanius dispar* (Rüppell, 1829) from Southern Iran

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The Arabian Killifish, *Aphanius dispar* (Rüppell 1828) has the widest distribution among all *Aphanius* species. In Iran, the populations of this species are found in all costal drainages of the Persian Gulf and the Sea of Oman, as well as in some inland basins. In spite of the wide distribution, little attention has been given to taxonomy and phylogeny of this species. Therefore, this study was designed to evaluate morphological differentiation of populations of *Aphanius dispar* in three geographically separated basins in southern Iran. A total of 162 specimens (with a standard length mean of 25-45 mm) were investigated from eleven different populations. Entirely, 22 meristic and morphological variables as well as otolith morphology (otolith shape) of specimens were analyzed. Univariate analysis of variance (One-way ANOVA, $p<0.05$) revealed significant phenotypic differences between populations of the three geographically separated basins for 31 out of 34 morphometric ratios and meristic characters. Discriminant Function Analysis (DFA) revealed that there are significant differences between populations of three basins with regard to the morphology of specimens as well as otolith shape (overall classification success is 97.5% and 80.7% respectively). Analysis of morphological and mercistic characters as well as otolith morphology supported a separation of isolated populations into three groups according to the three geographically isolated basins; One (group I) of which contains the otoliths of *Aphanius dispar* population from Makran (Minab) drainage, the second one is the group II which contains the populations of Hormuzgan basin and the third those of the group III which contain the populations of the Persian Gulf basin. Consequently, according to morphological analysis and data obtained from otolith morphology and morphometry, there are at least three geographically groups of *Aphanius dispar* populations in southern drainage basins of Iran. The molecular analysis of the different populations will provide additional information with regard to the taxonomical status and phylogeny of these populations.

Freie Themen – Poster

A new echinoderm Lagerstätte from the Pliensbachian (Early Jurassic) of the French Ardennes

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A succession of clays with thin shell beds from the French Ardennes, dated to the late Early Pliensbachian *Davoei* Zone and yielding abundant well-preserved remains of all five extant classes of echinoderms (Crinoidea, Asteroidea, Ophiuroidea, Echinoidea and Holothuroidea), is presented here as a new Lagerstätte. The echinoderms occur in the form of isolated ossicles, semi-articulated plate aggregates and abundant intact skeletons with even the most delicate appendices preserved in place and the finest skeletal structures hardly blurred by recrystallisation. The outstandingly good preservation of the echinoderm specimens allows for a morphological assessment of the represented taxa in detail only rarely achievable by fossil material. The material described herein thus significantly contributes to a better understanding of the systematic position and phylogenetic background of many Early Jurassic echinoderm taxa.

The echinoderms are considered to have been buried as an autochthonous or at least parautochthonous assemblage among clumps and beds of *Modiolus* bivalves. The depositional setting most likely represented a relatively shallow, near-shore soft-bottom environment in which conditions repeatedly favoured the settlement and subsequent effective burial of bivalve-echinoderm assemblages, leading to the formation of the thin highly fossiliferous shell beds intercalating the otherwise nearly sterile clays. The Sedan Lagerstätte opens a unique window into the palaeoecology of an extinct shallow-water soft-bottom community closely comparable to recent analogues.

Symposium J – Vortrag/oral presentation

From Monte San Giorgio to Southern China: the Middle Triassic fishes under a new light

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The most important localities for Middle Triassic Marine Vertebrates are concentrated in two areas: the Alps - on Monte San Giorgio - and Southern China - Guizhou and Yunnan Provinces. Through all the last century, Monte San Giorgio (MSG) has represented the major fossil-bearing site concerning marine fishes of that age; this was certified most of all, by the inscription of the Swiss side of MSG in the Unesco World Heritage List in 2003, while the Italian side joined the UNESCO List just last July! Actually, MSG is unique in having several fish (and reptile) levels, spanning more than 10 Ma, in a really small area, just within walking distance. The age is from Late Anisian - bottom of the Besano Fm (Grenzbitumenzone) - to latest Ladinian - upper Member of Meride Limestone (Kalkschieferzone). Until few years ago, the fish fauna contained in the Besano Formation was believed to witness the major radiation of 'Subholosteans', then considered the dominant Actinopterygian group in the Middle Triassic. Perleidiformes and Peltopleuriformes, in a very broad sense, are very common across the MSG sequence and looked the most specialized fishes of their times. Neopterygians were regarded as small and rather uncommon, with few exceptions, such as *Prohalecites*. Typical Mesozoic non teleostean-neopterygian groups like Semionotiformes, Pycnodontyformes, Pholidophoriphormes were known to appear only in the Norian, Late Triassic).

Only recently a sure Semionotid fish was described from the latest Ladinian; named *Sangiorgioichthys,* it was considered the oldest genus of the group, though very rare compared to most of the Subholosteans of its association. Now we know that already in the Middle Anisian *Sangiorgioichthys*, as well as many other very specialized neopterygians, was already very common in South China. Actually, the new century brought something really new and unexpected: Pelsonian (Middle Anisian) beds from southwestern China yield many new Neopterygian taxa together with a few Subholosteans. The new Pelsonian fauna shows that Neopterygians and Subholosteans had an almost contemporaneous radiation quickly following the decline of the typical Early Triassic fish fauna. However, after some of the new taxa migrated westwards, the two sides of the Tethys had somewhat different histories regarding Actinopterygians, at least throughout the remaining Triassic time.

Symposium B – Vortrag/oral presentation

How do recurrent patterns of covariation in molluscan shells connect to growth dynamics?

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Background: The comparison of shell shape between and within different clades of molluscs can be informative with regards to the basic rules of accretionary growth. In some ammonoids species, the spacing between growth halts covaries with aperture allometry and the intensity of ornamentation. To test whether this recurrent pattern of variation could reflect basic constraints tied to accretionary growth, we investigate the ontogenetic patterns of covariation between these shells characters in a population of gastropods (*Hexaplex trunculus*, Muricidae) originated from a single egg mass. We also report data on growth dynamics in the same sample.

Results: Variation in shell shape is analysed by geometric morphometrics of landmarks based on the aperture. We document an ontogenetic allometry of aperture, which becomes relatively wider with size. Variation in the 'strength of ornamentation' is related to mean spacing between growth halts,

spinier snails tending to have more widely spaced growth halts.

We report extensive variation in growth rhythm (frequency and amplitude of pulses of growth), in growth rates (e.g. mm shell length per day) and in shape of growth curves (presence/absence of a perceptible quiescent phase). The mean number of growth halts per month is related to the global shape of growth curves and to the mean spacing between growth halts: the more frequent the growth pulses, the shorter the time spent on a growth halt (nearly continuous growth), the more linear the growth curves and the smaller the growth segments between successive growth halts.

This study suggests a covariation between growth rhythm, growth halts spacing, aperture allometry and intensity of ornamentation. In particular, variation in growth rhythm is regarded as critical in generating the observed covariation between growth halts spacing and ornamentation. A growth vector model is used to simulate the formation of growth halts phenomenologically. This model is able to account for some of the covariation between shell characters among specimens. Such covariations are proposed to mainly result from simple scaling between the aperture dimensions and the lengths of shell segments between successive growth halts.

Conclusion: The covariation between growth halt spacing and intensity of ornamentation put into evidence in *H. trunculus* seems, at least at first glance, similar to that observed on highly variable ammonoids species. It suggests that variation in growth rhythm could have underlain some of the patterns of intraspecific variation in ammonoids known as Buckman's laws.

Symposium C – Poster

Repeated, independent range expansion/restriction pulses explain the diversity of the genus *Pacifigorgia* (Coelenterata, Octocorallia, Gorgoniidae) in the Galapagos Archipelago

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The influence of both warm and cold waters over the climatic and oceanographic conditions of the Galapagos islands, and the putative continuous influx of marine larvae from mainland eastern Pacific biogeographic provinces into the archipelago make Galapagos a natural laboratory for the study of both ecological and historical marine biogeography. In this study we examine the biogeography of the Galapagos archipelago from an historical perspective. For this purpose, we analyze the biogeographic history of 4 *Pacifigorgia* Bayer, 1951 species endemic to Galapagos from 31 reported for the eastern Pacific region. We clarify the sequence of dispersal-vicariance events that led to the current diversity of *Pacifigorgia* in the Galapagos province and evaluate whether the 4 *Pacifigorgia* species in Galapagos originated independently, from multiple dispersal-vicariance events into the archipelago, or as a result of a single dispersal event followed by intra-archipelago vicariance. Finally, we also discuss on the historical biogeography of other eastern Pacific oceanic Islands.

Symposium H – Vortrag/oral presentation

Palaeo-trans-Antarctic connections in *'Polymastia invaginata'* (Porifera: Demospongiae)? A case study using ribosomal (28S) DNA markers

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Recent molecular analyses of several putative circum-Antarctic species have shown the existence of clearly structured biogeographic patterns inconsistent with dispersal via the Antarctic Circumpolar Current. A recurrent pattern, viz. the closer evolutionary relationship between populations or species occurring in the Weddell Sea and the Ross Sea, located on opposite sides of Antarctica, has been repeatedly reported for diverse groups of organisms. Palaeo-trans-Antarctic connections between the Ross Sea and Weddell Sea areas in the Eocene-Oligocene predict this biogeographic pattern. Here, using ribosomal (28S; D14-E13) DNA markers, we explore the existence of a trans-Antarctic connection in the sponge *'Polymastia invaginata'*.

Symposium C – Vortrag/oral presentation

Past current affairs: phylogeography of the crown-of-thorns starfish in the Indian Ocean

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Understanding what past processes shaped the present distribution of biodiversity on coral reefs is essential for their conservation, especially in the light of future climate change. Molecular tools can increase our insight into these processes by identifying genetic breaks among and within species and obtaining a temporal framework for divergence times. Such phylogeographic studies are becoming increasingly common for the Pacific and Atlantic oceans, yet comparatively little is known about the biogeography and genetic structure of coral reefs in the Indian Ocean. We here present the first Indian Ocean-wide phylogeographic study of a coral reef associated organism, the crown-of-thorns starfish (COTS) *Acanthaster planci*, a coral predator infamous for its population outbreaks. Widespread marine organisms such as COTS have long been expected to display little genetic structure, due to their high dispersal potential and the apparent lack of barriers in the marine realm. Yet COTS are made up of four highly differentiated lineages that together form a species complex, located in the Pacific, the Red Sea, the Northern (NIO) and the Southern Indian Ocean (SIO). Using two mitochondrial markers with different mutation rates, we investigated and compared the two Indian Ocean lineages. We found COTS underwent two main diversification events, the first leading to the separation of the two lineages in the late Pliocene/early Pleistocene, the second to the formation of two subclades within each lineage around the onset of the last interglacial. From there on, the demographic history of the two lineages strongly differed, the SIO showing a signature of recent population expansion and hardly any regional structure, whereas the NIO maintained a constant size with highly differentiated regional groupings. This allowed us to gain further insight into the mechanisms driving the distribution of genetic diversity in the Indian Ocean and their relevance for conservation, with a particular emphasis on the importance of changing circulation patterns over time, while also enabling us to increase our understanding of a coral predator that remains a serious threat to coral reefs.

Symposium H – Vortrag/oral presentation

When morphology misleads: An example of problems with the taxonomy of extant Calcareous Sponges (Class Calcarea, Phylum Porifera)

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Calcareous sponges (Class Calcarea) are one of the four classes of phylum Porifera and are characterized by possessing calcium carbonate spicules in their skeleton. In the fossil record, the presumably polyphyletic group 'Pharetronida' were diverse and abundant and posses a rigid ‚hypercalcified' skeleton, which today is only found in small groups of the extant calcareous sponges. However, only few fossil calcarean remains can be linked to modern taxa, partly due to the rapid disintegration of non-rigid taxa into single spicules after their death. Unfortunately, spicules of Calcarea are relatively poor in complexity, compared to elaborate spicules in other sponge groups (e.g., in Class Hexactinellida), thus isolated spicules yield little taxonomically relevant characters – extant and fossil. The morphology-based taxonomy of extant Calcarea (esp. the definition of subclasses, orders, families and genera) relies mainly on the arrangement of spicules in the skeleton and on soft tissue characters (the organisation of the aquiferous system, and on class level, on histological features). Phylogenetic analyses with these morphological characters were as yet unsuccessful in resolving calcarean supra-specific relationships, apparently due to many homoplasies. Most hypotheses about the phylogeny of calcareous sponges were therefore based on untested typological hypotheses about the evolution of these characters.

Analyses of DNA sequences provide an independent source of information and previous studies already suggested that many taxa below the subclass-level are artificial groupings. Here we present results of an extended dataset and illustrate that extant Calcarea need a thorough taxonomic revision on many levels. We show that many species with close morphological resemblance are only distantly related.

By unravelling unexpected relationships, the evolution of some morphological features got clearer, while others still remain little understood. Our results have strong implications for any taxonomic work on extant Calcarea, and we suggest any such study should include DNA sequence analyses. Taxonomic revisions have to be undertaken on subclass level, until a better understood phylogenetic framework is established. Our results also caution taxonomic studies of fossil taxa with similar paucity of morphological information (especially when only based on isolated spicules), as apparently homoplasies can easily arise and may hamper correct species identification and reconstructing phylogenetic relationships.

Trace fossils from a pond in the rhaetoliassic Kamysh-Bashi Formation, SW-Kyrgyzstan, Central Asia

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The Kamysh-Bashi Formation is an 80 m thick succession of conglomerate, siltstone and minor sandstone, with intercalated deposits of laminated clay-siltstones. During the 2008/9 field seasons these clay-siltstones, interpreted as backswamp deposits, have yielded a diverse assemblage of insects and plants, comparable in number and quality to the underlying Madygen Formation. Additionally, pale violet to yellow-brown siltstones of a pond, located at the transition from an alluvial plain to a braid plain with volumetrically dominant overbank deposits, contain diverse ichnofossils.

Vertebrate ichnofossils

Undichna Anderson, 1976
Undichna unisulca Gibert, Buatois, Fregenal-Martínez, Mángano, Ortega, Poyato-Ariza and Wenz, 1999

The trace fossils can be characterized as comprising a single sinusoidal wave that is horizontal and continuous in all collected specimens; with an amplitude of c. 12 mm and a wavelength of c. 15 mm.

They are interpreted as locomotion trail of fish with a large caudal or anal fin. The relatively small wavelength implies the traces were created most likely by antero-posteriorly compressed fish with dorso-ventrally extended body.

Invertebrate ichnofossils

Arthropod ichnofossils *indet.*

Along with the ichnofossils, conchostracans in shell preservation up to 6 mm in length, smooth-shelled ostracodes and insect wings, mostly of the orders *Blattoidea* and *Coelifera*, are found. Body fossils of the trace makers are lacking.

The presence of fish traces implies that the pond was connected to a larger drainage network at least at some point in time, whereas the limited thickness of the deposit (14 cm of fine sandy siltstone) speaks against long-term stability of the water body. Relatively rare subhorizontal root imprints are related to a later episode of immature soil formation.

Character evolution, homoplasy and interrelationships of Sirenia

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The systematics of sirenians (sea cows) still is obscure because of the paraphyly of the Dugongidae including, amongst others, the Halitheriinae and, as such, the genus *Halitherium*. However, in recent studies the species-complex of the genus *Halitherium* for example is considered to be monophyletic.

The focus of this study is a revision of the *Halitherium*-species-complex with special reference to the species *H. schinzii*, best sampled from the lower Oligocene of Germany. Sea cow remains from the German Oligocene are usually assigned to this taxon assuming that this is the only sirenian species there. However, there is no valid definition of the species *H. schinzii* available to date, because its holotype merely consists of a single premolar, which is considered to have no diagnostic value. Consequently, its relation to the taxonomic name is doubtful or, at least, cannot be established. Therefore, *H. schinzii* is considered a *nomen dubium* as is the genus *Halitherium*, which is based on this species erection.

Accordingly, a morphological (re)-investigation of the available skeletal material and a phylogenetic analysis using robust cladistic principles is aspired. In addition to *H. christolii* from the late Oligocene of Austria and *H. taulannense* from the late Eocene of France, the set of taxa is complemented with the two species *H. alleni* and *H. antillense* from Central and North America for the first time. The status and affinities of several specimens actually considered invalid and synonymous with *H. schinzii* and *H. christolii* is furthermore tested and revised.

The cladistic analysis reveals that apomorphic characters are rare in order to justify many of the present taxa. The diagnoses of taxa are, conversely, predominantly based on character combinations composed of homoplasies, a not surprising result considering Sirenia as a group of mammals, which commonly adapted to life in water. However, on the basis of this morphological and systematic approach, the hypothesis of the presence of two different morpho-species of *Halitherium* at least in the early Oligocene of Germany is corroborated. A specimen known as „*Halitherium bronni*" consisting of a skullcap with very detailed morphology, especially in the area of the supraoccipital, is supported to be a valid taxon. The supraoccipital has never been considered before diagnostic, but this observation indicates that this element may contribute to a wider knowledge as to interspecific differences within Sirenia.

Symposium D – Vortrag/oral presentation

Ant-Fungal Parasitism - Ancient Death-Grip Leaf Scars from the Eocene of Central Europe

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Unusual insect behaviour and its consequences occasionally are preserved in the fossil record, but previously have not implicated parasites as agents of behavioural modification. Many fungi manipulate insects to bite leaves in a similar manner to *Ophiocordyceps unilateralis* and so this type of manipulation is a likely candidate to be captured in the fossil record through the examination of fossil leaves. Here, we report physical evidence for „death-grip" scars on damaged leaf tissue, induced by stereotypical control of ant behaviour by fungal infection.

1. The new discovery supports previous biogeographical enigmas. Recently, evidence from middle Eocene sites in Europe, especially from somewhat younger Baltic Amber (44.4 Ma) indicates considerable sharing of plant and insect taxa, and now associations, with modern Southeast Asia. The current study adds to that growing list, suggesting that the forests of Thailand may be the closest extant analog to Lake Messel of the mid Eocene (47.8 Ma).

2. The new use of fossil leaf-damage data support to understand parasitism in the fossil record. Typically such rare parasitic or parasitoidic associations between insects and fungi occur in amber. However, this association occurs on compression material, indicating a newfound use of distinctive, stereotypical damage that mirrors associations that are documented, often meticulously, from modern material.

3. It is a rare example of a tritrophic association using stereotypical and highly distinctive fossil leaf-damage. Elucidation of a tritrophic interaction involving (1) a plant host, (2) an ant clade, and (3) the ant's fungal parasite is rare in the fossil record of leaf damage. Another, albeit undocumented, example is a galled Patagonian leaf taxon with galls that contain several parasitoid emergence holes. Our discovery indicates that the fossil record of plant-insect associations can cascade up and down three trophic levels.

4. The dating of this unique parasitic association minimally to the mid Palaeogene, indicating a deep-time origin for this phenomenon. The modification of a fungally-induced behaviour in this ant taxon now has an origin occurring when many modern ant lineages were diversifying. This indicates that this highly specialized interaction is relatively ancient

Symposium B – Poster

Bivalve-dominated macrobenthic assemblage from the Upper Cenomanian (Cretaceous) of Saxony, Germany

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During the Early Late Cretaceous transgression, vast formerly emergent areas were flooded and transferred in shallow epi- and peri-continental shelf seas. In Saxony (Germany) this global transgression is documented by the onlap of shallow-marine sandstones of the lower Upper Cenomanian Oberhäslich Formation onto Palaeozoic basement rocks of the eastern Erzgebirge, a part of the Mid-European Island. The units were deposited as shallow-marine sand sheets and provided widespread firmgrounds with environmental conditions favourable for macrobenthic communities. Based on field observations south of Dresden (Gebergrund, Goldene Höhe, Welschhufe) and the study of collection material hosted in the Museum für Mineralogie und Geologie of the Senckenberg Naturhistorische Sammlungen Dresden, a reconstruction of the macrobenthic assemblage of the Oberhäslich Formation is intended.

The macrobenthos of the Oberhäslich Formation is dominated by relatively large bivalves, most notably *Inoceramus* ex gr. *pictus* (*I. pictus pictus* Sowerby, *I. pictus bannewitzensis* Tröger) (48%), *Rastellum cariantum* (Lamarck) (13%), *Rhynchostreon suborbiculatum* (Lamarck) (8%), *Gervillaria*? *neptuni* (Goldfuss) (8%), *Pinna cretacea* (Schlotheim), and *P. cottai* Geinitz (3%). Less common are smaller bivalve taxa such as *Neithea (N.) aequicostata* (Lamarck) (6%), accompanied by rare *Gervillia solenoides* Defrance, *Plagiostoma sowerbyi* (Geinitz), *Modiolus siliquus* (Matheron) and other modiolines. Gastropods are very rare to absent. Non-mollusc benthic invertebrates are likewise very rare and represented by irregular (*Holaster* sp., *Hemiaster* sp., *Catopygus*? sp.) and regular echinoids (spines of cidarids) as well as siliceous sponges (*Siphonia* sp. and reticulate morphotypes). As a rarity, the zonal index ammonite *Calycoceras naviculare* (Mantell) has been found, indicating an early Late Cenomanian age (*C. naviculare* Zone). Further nektonic components are nautiloids [*Cymatoceras elegans* (Sowerby)] and shark remains. Conspicuous large *Thalassinoides* and *Ophiomorpha* burrows indicate that crustaceans have been an important part of the infauna, associated with irregular echinoids and polychaetes. Bored wood remains point towards the presence of a vegetated hinterland. All body fossils are preserved as steinkerns in fine-grained, well sorted quartz arenites.

The benthic assemblage of the Oberhäslich Formation is moderately diverse, consisting of ~25 taxa, and is dominated by semi-infaunal (bakevelliids, modiolines, pinnids) and epifaunal (resp. epibyssate) suspension-feeding bivalves (inoceramids, oysters, pectinids, limids). (Deep-)infaunal bivalve taxa are missing. The large size of many of the bivalves suggests very good environmental conditions concerning food supply and oxygen availability (in contemporaneous fine-grained off-

shore sediments, some of the above mentioned bivalves also occur but reach much smaller maximum sizes). However, also taphonomic distortion may have biased the fossil record towards large specimens as smaller, delicate shells may have been preferentially destroyed by physical (storms, currents) or chemical processes (rapid shell dissolution during early diagenesis). A well oxygenated environment is also indicated by pervasive bioturbation which resulted in post-depositional homogenization of the sediments. Deposit-feeding taxa are comparably rare (a few irregular echinoids), which may hint to an organic-poor character of the substrate (clean, mature quartz sand). Commonly articulated bivalves suggest rapid burial, most probably by tempestites (graded shell beds are common in the lower Oberhäslich Formation in the Gebergrund and Goldene Höhe). However, significant lateral transport of shells can be excluded by the often excellent preservation of the fossils, and the preservation of many of the semi-infaunal taxa such as *Gervillaria*? *neptuni* (Goldfuss) in life position as indicated by their compaction along the length axis. A current-influenced, well-oxygenated and nutrient-rich nearshore environment below fair-weather but above storm-wave base is inferred for the studied localities.

Symposium B – Vortrag/oral presentation

Tempo of evolutionary change in the Early Turonian (Cretaceous) ammonite genus *Choffaticeras* Hyatt, 1903

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The uppermost Cenomanian – Turonian Maghra el Hadida Formation of the north Eastern Desert (Egypt) is a fossiliferous unit superbly exposed in the area of Wadi Araba (western bank of the Gulf of Suez). The Lower Turonian part of that formation was deposited in an open shelf environment and is very rich in ammonoids. A high-resolution integrated approach based on bio-, sequence and orbitally forced cyclo-stratigraphy provides a unique opportunity to track and calibrate the evolutionary pattern of the Early Turonian ammonite genus *Choffaticeras* Hyatt, 1903. This genus is abundant and well preserved in the Lower Turonian of the Maghra el Hadida Formation within a 15 m-thick sediment package. It documents conspicuous evolutionary changes by means of modification of morphological parameters such as whorl-section and tuberculation. Based on an orbitally tuned time model, it can be shown that the *Choffaticeras* lineage evolved within less than 400 kyr (Nagm 2009). Furthermore, the vertical distribution of individual *Choffaticeras* species' coupled with the mean sedimentation rate of 4.25 cm/kyr can be used to quantify species durations and pace of evolutionary changes.

The genus *Choffaticeras* is subdivided into two subgenera, i.e. *Ch*. (*Choffaticeras*) and *Ch*. (*Leoniceras*). The genus emerged with *Choffaticeras* (*Ch*.) *meslei* (Peron) which is the oldest species of this genus. It shows the diagnostic features of the genus (distinct ventrolateral keels or rows of tubercles on early whorls) and a ventral region resembling *Pseudotissotia* Peron, 1897 from which *Choffaticeras* seems to be derived. According to the time model elaborated for the Maghra el Hadida Formation, it first appeared ca. 93.48 Ma ago (~75 kyr after the start of the Turonian). Its last appearance (LA) is in the eastern Desert is only ca. 10 kyr after its first appearance (FA) associated with the FA of *Choffaticeras* (*Ch*.) *securiforme* (Eck), being a short-lived species of the genus (ca. 15 kyr). A new series of the subgenus *Choffaticeras* arose directly after the LA of *Choffaticeras* (*Ch*.) *securiforme*. It started with *Choffaticeras* (*Ch*.) *quaasi* (Peron) ~100 kyr after the beginning of the Turonian age. *Choffaticeras* (*Ch*.) *quaasi* persisted for ~80 kyr. In the last 7 kyr of its existence, forms of *Choffaticeras* (*Ch*.) *segne* (Solger) were developed. *Choffaticeras* (*Ch*.) *segne* is the species in the *Choffaticeras* lineage with the longest duration (~145 kyr). In the later stages of the existence of *Choffaticeras* (*Ch*.) *segne*, *Choffaticeras* (*Ch*.) *pavillieri* (Pervinquière) arose. *Choffaticeras* (*Ch*.) *sinaiticum* (Douvillé), which co-occurred with the last two species for only ~5 kyr persisted for another ca. 20 kyr. The last appearance of *Choffaticeras* (*Ch*.) *sinaiticum* was noted ~335 kyr after the start of the Turonian age. It marks the extinction of the subgenus *Choffaticeras* (~ 93.20 Ma ago). This means that the lifespan of the subgenus *Choffaticeras* is about 260 kyr. The subgenus *Leoniceras*, characterized by lanceolate whorl sections without ventrolateral keels or perceptible tubercles, appeared with *Choffaticeras* (*Leoniceras*) *luciae* (Pervinquière) which persisted for ~50 kyr. In the later stages of its lifespan it was accompanied by the short-lived *Choffaticeras* (*L*.) *barjonai* (Choffat). Finally, *Choffaticeras* (*L*.) *philippii* (Solger) arose, persisting for ~10 kyr and being the last representative of the genus *Choffaticeras*. The total duration the subgenus *Leoniceras* is only ~60 kyr, and thus the genus *Choffaticeras* existed for only a short interval of geological time (~320 kyr). The last appearance datum (LAD) of the genus was at ca. 93.14 Ma, being very close to the first appearance datum of *Mammites nodosoides* (the index of the upper Lower Turonian) according to correlation with time scales of the Early Turonian.

Nagm, E. (2009): Integrated stratigraphy, palaeontology and facies analysis of the Cenomanian – Turonian (Upper Cretaceous) Galala and Maghra el Hadida formations of the western Wadi Araba, Eastern Desert, Egypt. – PhD thesis, Würzburg University, p. 1–213. (http://www.opus-bayern.de/uni-wuerzburg/volltexte/2009/3988/).

Symposium K – Vortrag/oral presentation

Morphological and histological changes of dermal scalesduring the fish-to-tetrapod transition

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One of the most rapid morphological changes during the fish-to-tetrapod transition in the Devonian affected the skin. Apparently at roughly the same time when digits appeared, the rhombic scales of elpistostegids fishes (e.g. *Panderichthys*) were altered and differentiated into spindle-shaped or rhombic ventral gastral and dorsal round scales. Once established in early tetrapods, especially the gastral scales were retained as a conservative character in both amphibian and amniote lineages. Gastral scales are derived from the scales of elpistostegid fishes by an enlargement and differentiation of the internal and external articulation facets, shortening and broadening of the keel, and a proportional enlargement of the anterior overlap surface. These morphological changes caused a tighter connection between the gastral scales within a scale row and a greater anteroposterior overlap between the scale rows. Elpistostegids (and several osteolepiforms) have posterolaterally directed rows of rhombic scales on the ventral and on the dorsal side of the trunk. These rows meet on the ventrolateral side of the trunk in the so called 'ventrolateral ridge', which might represent the boundary between gastral and dorsal scales in early tetrapods. The posterolateral direction of scale rows was retained in the gastral scalation of most early tetrapods, whereas the arrangement of the round dorsal scales is modified to a transverse orientation in most taxa. The gastral and dorsal scales of early tetrapods can be traced back to the same *anlagen*. The dorsal round scale developed from a gastral scale-type by an alteration of the ontogenetic pathway. Spindle-shaped and rhombic gastral scales possess basically the same morphology. The spindle-shaped scale is the ontogenetic precursor of the rhombic scale at least in some temnospondyls. The variation of gastral scale morphology in different early tetrapods is caused, on the one hand, by ontogenetic truncation of development in several taxa, and by different allometric growth of parts of the scale on the other hand. Both gastral and dorsal scales of early tetrapods show a simplification of their histology compared with the scales of elpistostegid fishes. They uniformly consist of parallel-fibred bone with circumferential growth marks, and the thick basal layer of isopedine is completely reduced. In contrast to osteoderms of several temnospondyls and many amniotes, the gastral and dorsal scales of early tetrapods are periosteal and lack any components of metaplastic tissue. The proportionally larger overlap surfaces of gastral scales indicate that the body of early tetrapods might have been more flexible than that of their fish-like relatives. This is also indicated by the mode of articulation of gastral scales in the ventral midline and by the thin dorsal scales in most forms. Also the evolution of a 'nodal point' of scales posterior to the interclavicle might have contributed to an enhanced flexibility of the anterior trunk region and forelimbs.

Symposium G – Poster

Living in an extreme environment – Karpatian foraminiferal assemblages between marine and lacustrine influences in the Korneuburg Basin

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Estuarine deposits are extraordinarily well preserved in the Lower Miocene of the Korneuburg Basin, which is situated north of Vienna in Lower Austria. This region was apparently cut off from open waters for most of the Karpatian. The basin has two areas with significantly different ecological characteristics.

The northern portion of the Basin displays a mostly marine environment, while the southern region represents lacustrine or estuarine conditions.

Road construction near Stetten in Lower Austria has made a more or less complete east-west profile accessible for a detailed micropaleontological, sedimentological and ecological investigation of the southern part of the basin. Sediments were probed along seven profiles, covering a total length of 2.5 kilometres. In all, foraminiferal assemblages were examined from more than 150 samples. Two major foraminiferal assemblages were identified. The first is an *Ammonia*-dominated assemblage in association with few other shallow water benthic species, representing minimal water depths. Occasional occurrences of *Caucasina* and *Bolivina*, mostly associated with *Ammonia*, indicate low water energy and associated food accumulation and/or reduced oxygen levels.

The second group is dominated by planktic genera, like *Cassigerinella* or *Globorotalia,* which are indicative of „deeper" water and fully marine conditions.

We identified alternating occurrences of communities representing very shallow or estuary to fully marine, deeper water environments. Evidence for several intermediate environments was also found. A closer look at morphological variation in some samples clearly indicates high stress levels, including significant changes in size (dwarfism), or aberrant chamber growth.

Successive assemblages represent cycles of environmental change. The usually estuarine environment in the southern part of the basin must have experienced several periods of marine ingressions with the typical changes in water depth, salinity, and possibly temperature.

Examination of foraminiferal assemblages was accomplished within the scope of a joint project of the Austrian Geological Survey, the Natural History Museum of Vienna and the University of Vienna on the Karpatian of the Korneuburg Basin.

Symposium J – Vortrag/oral presentation

Jurassic dinosaurs from Asia: a review of recent discoveries

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Asia probably has the most complete and richest Jurassic dinosaur fossil record of any continent. This is particularly true for the Middle-early Late Jurassic, the most poorly known interval of dinosaur evolutionary history. In this paper, we review the known Jurassic dinosaurs of Asia, emphasising the Middle-early Late Jurassic dinosaur fossils recovered from two important areas in China: the Zhunggar Basin in the northwest of the country and an area centred on western Liaoning Province in the northeast (The rich record of Middle Jurassic dinosaurs from Zigong, Sichuan, is also important but there are few recent discoveries). Both areas have recently produced important dinosaur material from multiple major dinosaurian sub-groups. The recovered specimens often comprise nearly complete skeletons and in some cases even preserve soft tissues, thus providing significant new information on various aspects of Jurassic dinosaur anatomy and diversity. Biogeographically, these discoveries have reduced the distinctness of the Asian dinosaur fauna from those of other continents and also indicate some differentiation between northern and southern China during the Middle and Late Jurassic. Because the newly discovered taxa are in most cases basal members of their respective groups that are diversified in the Cretaceous, they play a significant role in analyses of dinosaur phylogeny. In some cases the data provided by these taxa have greatly reinforced previous conclusions, such as the monophyly of the Marginocephalia, the relatively basal positions of the Tyrannosauroidea and Alvarezsauroidea among the Coelurosauria, and the existence of a close relationship among the Dromaeosauridae, the Troodontidae, and *Archaeopteryx*. In other cases the new data have pointed to novel results, positing for example close relationships between the Heterodontosauridae and the Marginocephalia and among the Scansoriopterygidae, all other known avialans except *Archaeopteryx*, and probably the Oviraptorosauria as well. New information from these discoveries also shed light in the evolution of some important structures such as feathers and wings (especially the transformation from a five-fingered hand to a three-fingered hand in the theropod evolution). In combination with temporal information, these discoveries provide an important new perspective on the origin and early evolution of many dinosaurian sub-groups and particularly of the Avialae, suggesting that avialans and many other sub-groups probably originated and diversified during the Middle-early Late Jurassic. This diversification may be related to intense tectonic activity resulting in the breakup of Pangaea and dramatic climatic and environmental changes during this period.

Aus technischen Gründen konnten die folgenden Abstracts leider nicht alphabetisch einsortiert werden, wofür die Tagungsleitung um Entschuldigung bittet!

Symposium I – Vortrag/oral presentation

Aragonitic brachiopods in a calcite sea

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In contrast to other animal groups such as molluscs or bryozoans calcareous brachiopods appear to always have been calcitic. The only possible exceptions are trimerellids, a small Ordovician – Silurian group that has been suggested as having been aragonitic based on their consistently recrystallized shells. We analyzed specimens of trimerellids to test this hypothesis and found inclusions of original aragonite in samples from Gotland and the Hudson Bay lowlands (Canada). This extends the known record of original aragonite in the fossil record by more than 100 million years. Intriguingly, this means that the only ever aragonitic group of brachiopods originated in the palaeotropics of the Ordovician, the middle of a calcite sea interval. While their origins within brachiopods are poorly constrained, it appears highly unlikely that trimerellids evolved from an ancestral and so far overlooked aragonitic lineage that originated in the previous aragonite sea interval during the Early Cambrian. Their origins in the Ordovician point much more to the possibility of niches in tropical shallow marine environments in which aragonite was favoured over calcite. This is further supported by reports of primarily aragonitic algae and stromatoporoids from the fauna associated with trimerellids.

Symposium F – Poster

New material of *Prosansanosmilus eggeri* (Barbourofelidae, Feliformia, Carnivora): taxonomic additions and ecologic implications

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Recently, the species *Prosansanosmilus eggeri* has been established based on some dentition remains from Sandelzhausen (Northern Alpine Foreland Basin, Bavaria, Germany; European Land Mammal Zone MN5). An additional, hitherto not

described, most complete jaw fragment with m1 and p4 as well as alveols of p3 from this locality reveals further information on jaw morphology and size of this species. A detailed comparison with the sympatric carnivores from Sandelzhausen, further sabre-toothed cats (Nimravidae, Machairodontinae), and some extant cats contributes to morphologic characterization and systematic position of *P. eggeri* and the Barbourofelidae. Moreover, it allows conclusions on special functional morphology in comparison with other cats and ecological position within the carnivore fauna from Sandelzhausen.

Symposium D – Vortrag/oral presentation

Minimal age of *Nymphaea* subgenus Lotos is Upper Eocene

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Reinvestigation of historical fossil fruit specimens of Nymphaeaceae was performed. The first description of such fruits was by Unger (*Palaeolobium haeringiana* from the Lower Oligocene of Haering, 1850) and also by Ettingshausen (*Palaeolobium haeringiana*, paratype, 1852), but these were still described as legumes. Later, Saporta (1865; 1881) provided the description of *Anoectomeria brongniartii* (Upper Oligocene of Armissan and Lower Oligocene of Manosque) and recognized these findings and also *Palaeolobium haeringiana* (*Anoectomeria haeringiana*) from Haering as Nymphaeaceae. The fruits consist of an outer ring of fused stamens and an inner ring of eusyncarpous carpels with appendages, some fossils with bases of petals, sepals and also seeds being preserved. Friedrich (1883) described *Nymphaeites saxonica* (Lower Eocene of Bornstedt) and also revised *Palaeolobium* and *Anoectomeria* as the fossil genus *Nymphaeites*. Kirchheimer (1957) and Collinson (1980) affiliated all these species to the extant genus *Nymphaea*. Collinson (1980) described *Nymphaea* seeds (*Nymphaea limnis*) from the Isle of Wight (Upper Eocene to Lower Oligocene).

Reinvestigation of all morphological characters (according to Borsch et al. 2008) observable in principle in the fossils confirmed the expected apomorphies for the *Nymphaea* genus group (comprising *Victoria, Euryale, Brachyceras, Anecphya, Lotos, Hydrocallis*): arillus present (seen in *Nymphaea brongniartii*), perianth organ number 15-32, and dome-shaped floral base distinctly exceeding carpels. Testa with hairs is then an apomorphy for the subgenus *Lotos, Hydrocallis, Brachyceras*, and *Anecphya.* Furthermore, almost complete fusion of carpels in the fossils demonstrates that all fossil fruits mentioned above belong to Symphytopleura (eusyncarpous, fused more than 50%: *Lotos*, *Hydrocallis*), and not to Leptopleura (eusyncarpous, but fused less than 50%: *Brachyceras*, *Anecphya*). This is supported by presence of the apomorphic character "linear shape of carpellary appendages" for the genus Lotos. *Hydrocallis*, in contrast, shows "strongly clavate carpellary appendages". By this means, all cited fossil Nymphaeaceae fructifications can unambiguously be affiliated to the subgenus *Lotos* with its overall characteristic fruit discs.

The affiliation of fossil Nymphaeaceae fruits from well-dated localities to *Nymphaea* and specifically its subgenus *Lotos* allows correlation of paleontological data with the Nymphaeaceae phylogenetic tree based on morphological characters and its dating of divergence times by chloroplast DNA sequence analysis (Borsch et al. 2008; Löhne et al. 2008). The Eocene *Nymphaea saxonica* and the Lower Oligocene *Nymphaea brongniartii* already show almost completely fused carpels and carpellary appendages of linear shape and can thus be recognized as belonging to the subgenus *Lotos*. Hence the origin of *Lotos* and its divergence from *Hydrocallis* (strongly clavate carpellary appendages) (divergence point "10", Löhne et al. 2008) and, in consequence, the previous divergences within the genus *Nymphaea* (divergence points "5", "6", and "8") must be dated back to the Upper Eocene (approx. 40 myr). This is within the given time span for the basal divergence of the genus *Nymphaea* at 25,4 +- 14,3 myr (point "5"), but much older than the calculated divergence time for subgenus *Lotos* at 11,3 +- 7,8 myr (Miocene - Pliocene).

Freie Themen - Poster

Amber of the Senckenberg Museum: old collections, recent acquisitions and research perspectives

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The Senckenberg Museum is active in the field of palaeontological research and exhibitions for almost 200 years. Research on the Lagerstaette Messel and its dinosaur gallery made the museum famous around the world. Probably less well known is the fact that the Senckenberg Museum has amber collections since more than a century (the first amber pieces have been acquired in 1884). But, the amber material has only been occasionally studied.

Old collections of different ambers and copal are present in the museum. They are mainly represented by pieces of amber from the Baltic and Republic Dominican amber and from diverse sources of copal (subfossil resin), e.g. from Madagascar. Part of this material was acquired by the museum thanks to a number of collectors at the end of the nineteenth century, whilst another part has been bought more recently (starting 1998). However, most of this material remains poorly known and studied. Only few specimens have been included in more general studies. Until now, the amber material of the Senckenberg collections is spread among different departments and has not been treated as a whole.

Recently, the Senckenberg Museum acquired a very important amber collection, the Jörg Wunderlich-collection, by the help of an important donation of the Dr. Marschner Foundation. It comprises material of various ages starting from the Cretaceous, and of various regions (e.g., Baltic Sea, Dominican Republic, Myanmar, Madagascar...). This collection is one of the most diverse amber collections, especially with respect to spiders (it includes spiders belonging to more than 50 families).

It includes more than 200 holotypes, some of them representing the first fossil record of the respective family.

The acquisition of the Jörg Wunderlich-collection is a formidable occasion to develop amber research at the Senckenberg museum. Analyses of the fossil assemblages preserved in the collection and in the old amber collection of the Senckenberg museum will not only help to better understand the evolutionary history of many groups of arthropods, but also of certain plants and diverse microorganisms. All of these systematic data will help to unravel and understand the ecology of past forest ecosystems from different regions of the world. Their paleobiodiversity will be newly defined in more detail and their complexity will be studied and sometimes resolved for the first time. Special attention will be paid to the reconstruction of food webs in these environments.

Symposium A – Vortrag/oral presentation

The Molluscan-dominated benthic assemblages of the estuarine and shallow marine Upper Burdigalian deposits of the Korneuburg Basin in Lower Austria

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In the course of highway constructions (Wiener Außenring-Schnellstraße (S1)) a detailed sedimentological transect of 1.8 km length was logged in deposits of the Central Paratethys near the village of Stetten, N of Korneuburg in Lower Austria. A total of 324 sediment- and 118 molluscan samples was studied. The siliciclastic succession consists of pelitic and sandy sediments and sandstones and is rich in fossils. The fossil remains consist of sponges, corals, serpulids, molluscs, balanids, echinoderms, fish and micromammals. Quantitatively the molluscs dominate and have been studied in detail. 139 species were determined from more than 11,000 shells. Two gastropod species, *Agapilia pachii* und *Granulolabium bicinctum* make up more than 53% of the assemblage. Another 11 species (*Nassarius edlaueri, Bittium spina, Loripes dujardini, Hydrobia* spp., *Paphia subcarinata, Cyllenina ternodosa, Turritella gradata, Corbula gibba, Cerastoderma praeplicata, Striarca lactea, Sandbergeria perpusilla*) each contributes more than 1% to the total molluscan composition, but all other 126 species are quantitatively unimportant. A conspicuous alternation between intertidal and shallow subtidal mollusc associations is evident. The intertidal is dominated by the superabundant *Agapilia pachii* and *Granulolabium plicatum*, whereas the heavily bioturbated fully marine subtidal is characterized by a more diverse assemblage including *Turritella gradata*, *Nassarius edlaueri*, *Anadara diluvii* and various venerids. Additionally, layers with large fragments of *Crassostrea* and thin coal deposits with *Terebralia bidentata* are quite abundant in the section. Washed in land snails (e.g., Planorbidae) and river snails (Melanopsidae) occur occasionally. This faunal composition, along with its typical alternation points to a vivid dynamic within this Lower Miocene, subtropical ecosystem in the paleo-estuary of the southern Korneuburg basin.

Symposium J – Vortrag/oral presentation

Contents of old Tendaguru bamboo corsets from quarry IG revealed by computed tomography

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The German Tendaguru-Expedition was one of the most successful palaeontological field campaigns worldwide. From 1909 to 1913, the field crews, led by scientists of the Museum für Naturkunde in Berlin, dug out more than 230 tons of dinosaur material. The material comprised around 13 different species of dinosaurs, among them the famous skeleton of *Giraffatitan* (*Brachiosaurus*) *brancai*. While most of the bones have been fully prepared over the time, there are still 41 original and unopened bamboo transport corsets preserved. The fossil content of these transport boxes was excavated from quarry IG, which yielded mostly skeletal material of the small orthithopod *Dysalotosaurus lettowvorbecki*. Originally, much bone material was known from *Dysalotosaurus*, but a larger part of the material was destroyed during WWII and before precise description. A scientific cooperation between the Museum für Naturkunde and the Leibniz-Institute for Zoo and Wildlife Research now made it possible to investigate all 41 bamboo corsets with a new high-performance tomograph (Toshiba Aquilion CX), and to reconstruct all of the preserved bones within the boxes. The content of these boxes was not unexpected, as it revealed a high number of well-preserved bones (vertebrae, pelvic bones, femura, tibiae, metapodials etc.) of *Dysalotosaurus*. However, among the finds are also some vertebrae of *Kentrosaurus* and a cervical rib of *Giraffatitan* (*Brachiosaurus*). These new data are valuable in several aspects: they make the completion of the expedition inventory possible and deliver valuable new taphonomic data to the content of quarry IG. For example, element determination and size differences of the *Dysalotosaurus* bones can be assessed directly and without time-consuming preparation and allow new discussion of the hypothesis of a possible mass mortality event in the locality IG. Finally, preparation of selected bones for supplementing missing bone elements of *Dysalotosaurus* and preparation of other interesting bones out of the samples becomes possible by preselection.

Symposium A – Vortrag/oral presentation

Teilskelett eines *Geotrypus* (Mammalia, Talpidae) aus dem Oberoligozän von Enspel

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Belege fossiler Maulwürfe aus dem Paläogen Europas sind selten und beschränken sich meist auf isolierte Zähne und Bruchstücke von Zahnreihen, bzw. einzelne Knochen des Postcranialskeletts. Obwohl die Humeri der Maulwürfe sehr charakteristisch sind und zur Artabgrenzung benutzt werden können, lassen sie sich isolierten Zähnen nur bedingt, meist nur nach der Größe zuordnen. Der älteste Beleg eines Talpiden in Europa stammt aus dem Obereozän der Isle of Wight (GB) und umfasst nur zwei isolierte Molaren.

Zur Gattung *Geotrypus* werden acht valide Spezies und mindestens vier nicht benannte Formen gerechnet. Damit ist sie eine der diversesten Maulwurfgattungen überhaupt, wobei sich die Dokumentation allerdings nur auf wenige Funde bezieht. Ab dem MP 24 (Ober-Oligozän) treten zwei Arten von *Geotrypus* auf. *G. antiquus* ist die größere der beiden Arten und hat eine vollständige eutherische Zahnformel, während der kleinere *G. acutidentatus* nur zwei Inzisiven im Unterkiefer aufweist. Weitere Arten sind im obersten Oligozän und unteren Miozän gefunden worden. Die Gattung *Talpa*, die einzige rezente Maulwurfsgattung in Europa, tritt erstmals in MN 2a (Unter-Miozän) auf. Bis zum MN 4 kommt sie gemeinsam mit *Geotrypus* vor, danach sind keine Funde der älteren Gattung mehr bekannt. Das Teilskelett aus Enspel bietet die seltene Gelegenheit artikuliertes Zahn- und Postcranialmaterial zu untersuchen. Obwohl nur ein Teil des Skeletts überliefert ist, ist dies eine bedeutende Referenz und Ergänzung zu isolierten Zähnen und Knochen. Auch ist somit eine ganz neue Grundlage für den Vergleich von *Geotrypus* und *Talpa* gegeben.

Der hier beschriebene Maulwurf wurde 1995 während der Forschungsgrabung der Generaldirektion Kulturelles Erbe Rheinland-Pfalz in Enspel gefunden und nach der Transfermethode auf Epoxidharz präpariert. Die Seeablagerungen in Enspel (MP 28) bilden eine Konservatlagerstätte, die schon mehrfach bedeutende Säugetier-Funde geliefert hat. Der Fund umfasst den stark kompaktierten Schädel und die beiden Unterkiefer mit fast vollständiger Bezahnung. Darüber hinaus sind Teile des Schultergürtels (Scapulae, Calvicula) und der Arme (Humeri, Radii, Ulnae), sowie einige Knochen der Handwurzel und der Finger überliefert. Ein Os falciforme, ein zusätzlicher Knochen, der die Hand verbreitert und bei allen rezenten Maulwürfen bekannt ist, ist ebenfalls erhalten. Hierbei handelt es sich dabei um den ältesten Nachweis dieses Knochens. Außerdem sind sieben Wirbel, zwei Rippen und das linke Femur erhalten. Insgesamt handelt es sich damit um einen der umfassendsten Funde eines fossilen Maulwurfs.

Die in der künstlichen Matrix verborgenen Partien der Knochen wurden mit Hilfe der Mikro-Computertomographie und anschließender digitaler Bearbeitung rekonstruiert. Die Zuordnung zu *G. antiquus* basiert auf Merkmalen des Humerus und des Gebisses, sowie der Größe des Tieres. Mit dem vorliegenden Stück können erstmals Gebissmerkmale und Merkmale des Humerus sicher kombiniert werden und zur phylogenetischen Analyse, die im nächsten Schritt erfolgen soll, verwendet werden.

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