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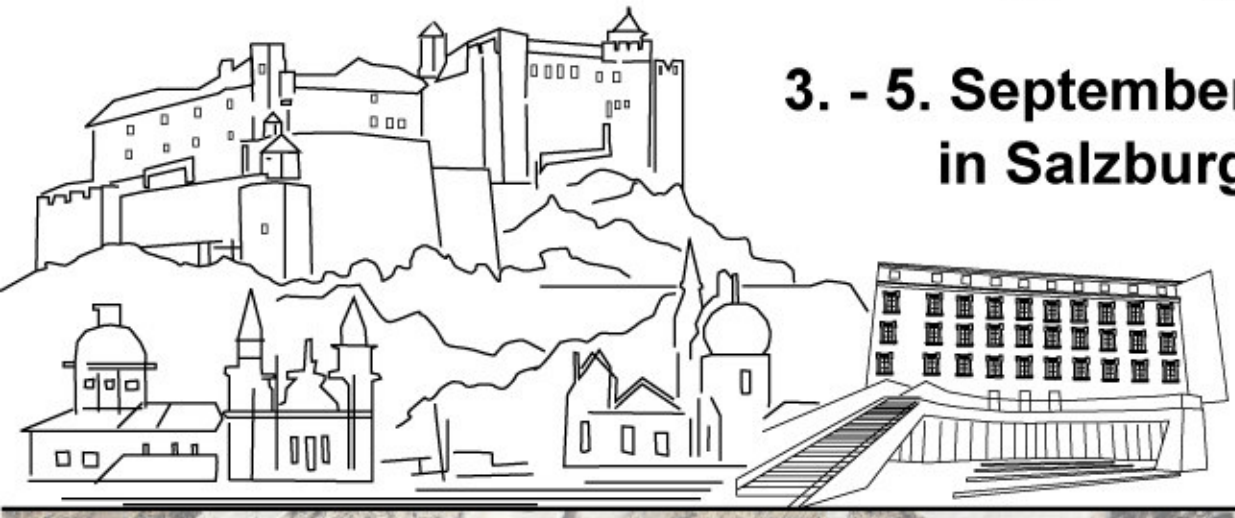

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Programm & Kurzfassungen

Kurzfassungen der Vorträge

Herausgegeben von Iris Feichtinger

Schönheiten im Stein - Fossilien aus dem Salzburger Land

ALFRED LEIBLFINGER[1]

[1]Haus der Natur, Museumsplatz 5, 5020 Salzburg

Das Salzburger Land ist berühmt für seine artenreiche marine Fauna. In diesem Vortrag werden einzigartige und selten gezeigte Fossilien diverser mesozoischen Fundstellen vom Fund bis zum fertigen Exponat vorgestellt.
Das besondere Augenmerk liegt hierbei bei Fossilien der Adneter-, Schrammbach- und Rossfeldschichten, sowie der Gosauformation mit ihren wunderbaren Cephalopoden, Gastropoden und fossilen Korallen. Durch akribische Sammeltätigkeit und aufwändiger Präparation geben die Fundstücke viele neuen wissenschaftliche Erkenntnisse preis, welche durch langjähriger, guter Kooperation stets der Forschung zur Verfügung gestellt werden. Die Besonderheiten der Sammlung umfassen Ammoniten der Gattung *Forresteria* in Schalenerhaltung, Flügelschnecken, Mondkorallen sowie ein kreidezeitlicher Ichthyosaurierzahn.

Viele der gezeigten Fossilien aus der Salzburger Region werden kaum von Laien erkannt oder nicht fachmännisch Präpariert und bleiben daher häufig im Verborgenen. Die angeeignete Erfahrung durch jahrelanger Erprobung verschiedenster Präparationsmethoden der meist sehr fragilen Fossilien ermöglichte es, eine umfangreiche Sammlung aufzubauen, welche neben wundervoll erhaltenen Exemplaren auch einige Belegstücke beinhaltet.
Einblicke in Privatsammlungen und der Sammeltätigkeit, sowie der Erfahrungsaustausch zwischen Wissenschaftlern und engagierten Sammlern ist "Vertrauenssache", welches dem Vortragenden ein besonderes Anliegen ist und sich freut hiermit einen Beitrag für die Forschung leisten zu können!

Das Geologische Erbe der Karnischen Alpen

HANS PETER SCHÖNLAUB[1] & HOLGER FORKE[2]

[1]Kötschach 350, 9640 Kötschach-Mauthen, Österreich
[2]Lychener Straße 54, 10437 Berlin, Deutschland

The new book summarizes almost 200 years of scientific research in the Paleozoic sequences of the Carnic Alps. Main focus is laid on new results starting in the second half of the 20th century carried out on both sides of the mountain chain, i.e. in southern Austria and northern Italy. We stress the importance of applying not only a cross-border cooperation but also new geoscientific disciplines, methodologies and techniques, which enable a well-founded knowledge basis to decipher the long-lasting history of this region starting in the Ordovician and ranging to the middle Triassic. During this long time the Carnic Alps were travelling from high southern latitudes towards north to tropical and equatorial realms. During the Permian they crossed the equator to drift in the following periods slowly to the present position.

The geological heritage of this well-known sedimentary sequence ranges from spectacular rocks of shallow water to the deep ocean, embracing fossiliferous Ordovician and Silurian shallow to deep water rocks and faunas, lagoonal, reef, fore-reef and off-shore sequences of the Devonian, Flysch deposits of the Lower and Middle Carboniferous ending up in the Variscan orogeny. Following this structural break post-orogenic molasse sediments provide impressive insights into the rich past life of several animal and floral groups which inhabited the land and shallow sea.

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Welcome back!? The return of the LBF *Amphistegina* to the Mediterranean: Implications for the local diversity in Corfu (Greece)

ANNA E. WEINMANN[1], MARTIN R. LANGER[2] & MARIA V. TRIANTAPHYLLOU[3]

[1]Natural History Museum Vienna, Geological-Paleontological Department, Burgring 7, 1010 Vienna, Austria
[2]Rheinische Friedrich-Wilhelms-Universität Bonn, Institute of Geosciences, Section Paleontology, Nussallee 8, 53115 Bonn
[3]National and Kapodistrian University of Athens, Faculty of Geology and Geoenvironment, Panepistimioupolis 15784, Athens, Greece

Larger benthic foraminifera (LBF) of the genus *Amphistegina* were widespread in the Mediterranean Sea during Miocene and Pliocene times. After a hiatus, they have successfully returned to the area – probably via the Suez Canal – and have expanded their distribution ranges throughout the Eastern and Central Mediterranean. *Amphistegina lobifera* is the most prolific species and its current northwestern range limit lies in Tunisia, the Pelagian Islands (Italy) and Albania. Locally, high abundances have been reported, affecting biodiversity and assemblage compositions. Therefore, the species was named among the most significant invaders (Stulpinaite et al. 2020).

We analyzed foraminifera from Corfu Island in the Central Mediterranean, where amphisteginids have been absent during the Pleistocene (Rögl et al. 1998). We evaluated the effect of *A. lobifera* on the diversity of all foraminifera and specific groups in particular.

Our findings suggest that *A. lobifera* does affect the local diversity. We found negative correlations with sessile epiphytes and small miliolids. Both groups occupy comparable habitats as *A. lobifera* and might be outcompeted by the latter, which is probably further facilitated by ongoing ocean warming. Comparisons with Pleistocene material (Rögl et al. 1998) suggest that epiphytes and small miliolids dominated the assemblages prior to the arrival of *Amphistegina*. Other LBF (*Peneroplis*, *Sorites*) initially showed a positive correlation with the presence of *A. lobifera* (until the latter reached more than 20%). This suggests that other warm-affiliated taxa also benefit from warmer ocean temperatures.

We expect that *A. lobifera* and other warm-adapted taxa might play an increased role in shaping the future biodiversity and assemblage compositions in this area. This would facilitate the prognosed tropicalization of the Mediterranean Sea (Bianchi et al. 2013).

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Taxonomy has no shortcuts – why revisions are crucial for data analysis in Paleontology

MATHIAS HARZHAUSER[1] & BERNARD M. LANDAU[2]

[1]Natural History Museum Vienna, Burgring 7, 1010 Vienna, Austria
[2]Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, Netherlands; Instituto Dom Luiz da Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal; and International Health Centres, Av. Infante de Henrique 7, Areias São João, P-8200 Albufeira, Portugal

Great efforts have been devoted during the last decade to digitalize paleontological data. Flagship of these projects are the Paleobiology Database (https://paleobiodb.org/#/) and Fossilworks (http://fossilworks.org). These projects utilize literature data within a standardized taxonomic and stratigraphic frame and aim at detecting changes in diversity patterns on various temporal and spatial scales. Whilst this approach clearly has great potential, it carries the danger of producing "pseudo-revisions" by automated new combinations of higher systematic ranks. Moreover, we doubt that this approach can be used seriously for species-level analysis without careful and time-consuming revision of the input-data. An impressive example are our revisions of the Miocene gastropod families Cancellariidae, Columbellidae, Conidae, Costellariidae, Mitridae and Turritellidae from the Paratethys Sea. These revisions revealed major problems in previous generic placements resulting in up to 80% of new combinations. In some families, species level identifications of putatively wide-spread species, seemingly known also from the Mediterranean Sea and the northeastern Atlantic, turned out to be incorrect. Prior to these Paratethyan revisions, relationships with the northeastern Atlantic would have been considered high. However, following these revisions, such relationships were found to be almost non-existant. Similarly, the relationship with stratigraphically younger Pliocene faunas decreased drastically after revision. Furthermore, the literature-data would have completely failed to detect the faunistic relation between Paratethyan faunas and those of the tropical eastern Atlantic. Finally, a survey of species identifications in Paratethyan literature documented that up to 80% of the species identifications have been wrong in families such as the Conidae and Turritellidae. Thus, putting these data uncritically into databases will produce more noise than signal.

Bivalves from the Innviertel Group of Allerding in the North Alpine Foreland Basin (lower Miocene, Upper Austria)

OLEG MANDIC[1], SIMON SCHNEIDER[2], MATHIAS HARZHAUSER[1] & WOLFGANG DANNINGER[3]

[1]Geological-Paleontological Department, Naturhistorisches Museum Wien, Burgring 7, 1010 Vienna, Austria
[2]CASP, West Building, Madingley Rise, Madingley Road, Cambridge CB3 0UD, UK
[3]Hauptstraße 83, 4794 Kopfing, Austria

During the Ottnangian (Burdigalian, early Miocene), the North Alpine Foreland Basin operated as a sea-way connecting the Central Paratethys Sea with the Rhône Basin in the Western Mediterranean. Within this short time window, an intensive faunal exchange between the two paleobiogeographic units occurred, which is reflected in macrofossil assemblages. The extraordinarily rich fossil record of the study site, Allerding, located in the westernmost Central Paratethys, provides valuable insights into the composition and origins of the bivalve fauna colonizing the marine gateway. The site documents the early Ottnangian marine transgression over deeply weathered crystalline basement, grading from fossil bearing shallow water clay and sand into the open marine "Schlier" facies of the Ottnang Formation.

Despite considerable taphonomic overprint including aragonite leaching and mechanical abrasion of bivalve shells under turbulent shallow-water conditions, a total of 46 species are recorded, including two new species (Lima allerdingensis and Astarte danningeri). The dominance of suspension feeders, and the presence of several deposit feeders and chemosymbiotic taxa point to well diversified inshore settings, including low intertidal mudflats, as well as seagrass meadows. An abundance of primary and secondary hardgrounds is reflected in the high number of cementing and byssate species, as well as in the occurrence of species drilling actively into hard substrate. Finally, the dominance of active burrowers suggests a patchwork of habitats, where sandy and muddy soft bottoms occur interspersed.

Biostratigraphic analysis constrains the deposits to the early to middle Ottnangian, based on the presence of the index species Flexopecten davidi and the concurrence of several taxa, which have their last or first occurrences within this interval. These are predominantly taxa persisting into the Badenian, therefore allowing for a straightforward differentiation between late Eggenburgian and early Ottnangian assemblages. While a few Central Paratethys endemics reflect a continued semi-isolated position of the area, the majority of the newly arriving species are shared with the Mediterranean and NE Atlantic, documenting the establishment of a faunal migration route via the North Alpine Foreland Basin.

Die Untermiozän-Mittelmiozän-Grenze (Karpatium-Badenium) in der "Kremser Bucht"(NÖ): Probleme und Lösungen für die Korrelation von Bohrkernen mit Mikrofossilien (Foraminiferen, kalkiges Nannoplankton) und erste Ansätze einer Paläoklimainterpretation

HOLGER GEBHARDT[1], ANNEKATRIN ENGE[1, 2], BETTINA SCHENK[2], STJEPAN ĆORIĆ[1], PETRA HEINZ[2]

[1]Geologische Bundesanstalt, Neulinggasse 38, 1030 Wien
[2]Institut für Paläontologie, Universität Wien, Althanstraße 14, 1090 Wien

Foraminiferen und kalkiges Nannoplankton sind für die biostratigraphische Zonierung von marinen Sedimenten im Neogen der Paratethys die wohl geeignetsten Fossilgruppen. Bedingt durch die relativ geringe Wassertiefe und Unterbrechungen der Verbindung zum offenen Ozean treten globale Leitfossilien aber oft nur sporadisch oder sogar gar nicht auf. Dies gilt ganz besonders für die Gegend um Krems (NÖ), die den westlichen Randbereich einer Meeresbucht der Zentralen Paratethys darstellt. Wir präsentieren die Ergebnisse der Korrelation von vier Bohrkernen (Krems Landesgalerie, Gneixendorf, Diendorf, Franzhausen) anhand von kalkigem Nannoplankton, Leitarten ausgewählter planktischer und benthischer Foraminiferen und lithologischer Eigenschaften (Sandanteil). Aus den Neogenbecken Österreichs bekannte Schichtlücken finden sich auch im Raum Krems wieder. Insbesondere das Vorkommen von Praeorbulina und Orbulina, die Aufrollungsrichtung bei Globorotalia bykovae und die Häufigkeiten von Cibicidoides lopjanicus und Cassigerinella spinata können für die stratigraphische Unterscheidung der Stufen herangezogen werden. Auf dieser Basis können auch Sandlagen bzw. Bereiche erhöhter Sandsedimentation zwischen den Bohrungen korreliert werden und eine altersmäßige Einstufung der bearbeiteten Kerne durchgeführt werden. Der Kern Landesgalerie Krems ist zwar aufgrund der geringeren Sedimentationsrate der kürzeste, reicht aber vom oberen Karpatium bis in das mittlere Badenium. Der Kern Gneixendorf kann vollständig in des Badenium eingestuft werden, ebenso der obere Teil des Kerns Diendorf. Der untere Teil des Kerns Diendorf und der gesamte Kern Franzhausen bestehen aus karpathischen, also untermiozänen Sedimenten. Aus der Verteilung von Warm- und Kaltwasserarten im Kern Landesgalerie Krems können für das Badenium Klimazyklen abgeleitet werden.

Paläontologie in der Schule

Magnus Lantschner[1]

[1]Verein natopia, Steinbockalle9, 6063 Rum

Fossilien begeistern Kinder, Steine begeistern Kinder
Wir können diese Begeisterung nutzen um den Kindern das Konzept der Tiefe der Zeit zu vermitteln. Und das ist das wichtigste was die gesamten Erdwissenschaften in unserer modernen Bildungslandschaft zu sagen haben.
Beim Verein natopia versuchen wir seit über 10 Jahren dieses Konzept und das Verständnis über das Werden der Erde und der Entwicklung des Lebens zu vermitteln. Wir stellen in dem Vortrag unsere Methoden kurz vor und präsentieren unsere Erfahrungen.

Alter Aufschluss, neue Funde und Interpretationen: die Transgressionsabfolge von Unterrudling bei Eferding (Egerium, Oberoligozän)

BJÖRN BERNING[1], THOMAS FILEK[2], FELIX HOFMAYER[3], IRIS FEICHTINGER[4,5], JÜRGEN POLLERSPÖCK[6], JENNIFER ZWICKER[7], DANIEL SMRZKA[7], JÖRN PECKMANN[8], MATTHIAS KRANNER[4], OLEG MANDIC[4], BETTINA REICHENBACHER[9], ANDREAS KROH[4], ALFRED UCHMAN[10], REINHARD ROETZEL[3] & MATHIAS HARZHAUSER[4]

[1]Geowissenschaftliche Sammlungen, Oberösterreichische Landes-Kultur GmbH, Welser Str. 20, 4060 Leonding, Österreich

[2]Institut für Paläontologie, Universität Wien, Althanstraße 14, 1090 Wien, Österreich

[3]Geologische Bundesanstalt, Neulinggasse 38, 1030 Wien, Österreich

[4]Geologisch-Paläontologische Abteilung, Naturhistorisches Museum Wien, Burgring 7, 1010 Wien, Österreich

[5]University of Graz, NAWI Graz Geocenter, Institute of Earth Sciences, Austria

[6]Zoologische Staatssammlung München, Münchhausenstraße 21, 81247 München, Deutschland

[7]Institut für Geologie, Universität Wien, Althanstraße 14, 1090 Wien, Österreich

[8]Institut für Geologie, Universität Hamburg, Bundesstr. 55, 20146 Hamburg, Deutschland

[9]Department für Geo- und Umweltwissenschaften, Ludwigs-Maximilian-Universität, Richard-Wagner-Str. 10, 80333 München, Deutschland

[10]Institute of Geological Sciences, Faculty of Geography and Geology, Jagiellonian University, Gronostajowa 3a, 30-387 Krakau, Polen

Auch nach mehreren Jahrzehnten der Erforschung wartet die egerische Transgressionsabfolge von Unterrudling bei Eferding (Oberösterreich), welche den Übergang der Flachwasserablagerungen der Linz-Melk Formation zu den Tiefwassersedimenten der Eferding Formation (EF) umfasst, noch mit Überraschungen auf. So war kurzzeitig eine Schicht in der siltig-tonigen EF aufgeschlossen, die eine Vergesellschaftung von Tiefseekorallen und -bivalven enthielt und vermutlich den ältesten Nachweis dieser rezenten Biozönose darstellt. Dank neuer Funde und Analysen von Foraminiferen, Spurenfossilien sowie Knorpel- und Knochenfischen konnten die Umweltbedingungen und Ablagerungstiefen exakt rekonstruiert werden. Eine geochemische Analyse der phosphatischen Konkretionen in der EF deutet zudem auf eine Eutrophisierung des küstennahen Molassemeeres hin. Ein feuchtes, subtropisches Klima im spätoligozänen Alpenvorland konnte anhand der überlieferten Pflanzenfossilien nachgewiesen werden.

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A look inside: MicroCT analyses of fossils at the NHMW

VIOLA WINKLER[1] & ANDREAS KROH[1]

[1] Geological-Paleontological Department, Naturhistorisches Museum Wien, Burgring 7, 1010 Vienna, Austria

Viele Museumsobjekte sind einzigartig, wie, zum Beispiel, die letzten bekannten Exemplare ausgestorbener Tiere oder Pflanzen, aber auch außergewöhnlich erhaltene Fossilien oder archäologische Funde. Für die Erforschung ist es oft nötig die innere Struktur dieser Stücke zu untersuchen. Bei seltenen oder unwiederbringlichen Objekten sind solche Untersuchungen auf herkömmlichen Weg jedoch nicht möglich, da die Untersuchung von Innenstrukturen nicht ohne Veränderung, oder, in manchen Fällen Zerstörung, des Objekts, möglich ist. Mittels Mikrocomputertomographie-Verfahren (MicroCT) ist es mit Hilfe der verwendeten Röntgenstrahlung möglich innere Strukturen vieler Objekte darzustellen. In dem von der Österreichischen Forschungsförderungsgesellschaft (FFG) geförderten Projekt „MicroMus: Unlocking the Microcosm – Micro-CT Analyses in Museum Collections“ konnte am NHM Wien ein 3D Labor etabliert werden. Im Zentrum dieser Infrastruktur steht ein modernes, hochauflösendes MicroCT-System. Mit diesem Gerät können Proben mit einer Größe bis zu 60 cm Länge und 50 cm Durchmesser untersucht werden. Fossilien stellen aufgrund ihrer teils sehr hohen Dichte eine Herausforderung für MicroCT-Analysen dar. Das neue Gerät bietet mit seinen zwei Röntgenquellen und hoher Leistung die Möglichkeit diese Probleme in vielen Fällen zu überwinden. Zusätzlich sind bei Fossilien, im Gegensatz zu Proben moderner Organismen, die Dichteunterschiede zwischen dem einbettenden Sediment (außen anhaftend oder in ehemaligen Hohlräumen) nicht immer ausreichend um diese Materialien voneinander zu unterscheiden. Der Grund dafür ist, dass der überwiegende Teil der erhaltenen Fossilien aus Kalzit und/oder Aragonit besteht, ebenso wie das umgebende Sediment, welches oftmals, zumindest z. T., auch biogenen Ursprungs ist. Anhand von ausgewählten Beispielen werden in diesem Vortrag die Möglichkeiten und Limitierungen der Mikrocomputertomographie aufgezeigt, sowie das neue 3D Labor des NHM Wiens vorgestellt.

„Mahlzeit! – Vom wilden Hai gebissen“ Fundgeschichte, Bearbeitung und Ereignisse durch den Fund einer fossilen Seekuh 2012 in Retznei Stmk.

GERHARD WANZENBÖCK[1]

[1]Breitegasse 7, 2540 Bad Vöslau

Einer der Hauptaufgaben der ÖPG ist es Wissenschaftler und Laien zusammenzubringen, um bei persönlichen Gesprächen gegenseitiges Vertrauen und Wertschätzung aufzubauen. Denn nur so ist eine für beide Seiten „gewinnbringende“ Zusammenarbeit möglich. Ein Beispiel dafür soll ein Seekuhfund sein, der mir 2012 im Lafargewerk Retznei glückte.

Im Werk Retznei werden Leithakalke (Weissenegg Formation) aus dem Miozän/Badenien im großen Stil abgebaut und zu Zement weiterverarbeitet. In diesen Kalken findet sich eine reiche Fauna und Flora, die hier einst vor ca. 14 – 15 Mio. Jahren in einem warmen, flachen Meer (Paratethys) gelebt hat. Eine dieser Tierarten waren Seekühe (Gabelschwanzseekuh *Metaxytherium* cf. *medium* DEMAREST, 1822), die im meeresbedeckten Grazer Becken, in Seegraswiesen zwischen Fleckenriffen (patch reefs) einen idealen Lebensraum fanden. Immer wieder werden beim Abbau Knochen oder sogar ganze Skelette dieser friedlichen, pflanzenfressenden Tiere gefunden. Leider ist ein Sammeln im Werk Retznei nur sehr bedingt möglich. Durch jahrelangen guten Kontakt zu den Steinbruchmeistern, der auch hier nur durch gegenseitiges Vertrauen und Wertschätzung möglich ist, war mir ein Begehen des Bruchgeländes erlaubt. In einer sehr basisnahen, harten, grauen Sandsteinlage entdeckte ich Knochenteile, die sich bei genauerer Begutachtung als Seekuhreste herausstellten. Es waren Teile des Kopfes, ein Zahn und Rippenfragmente zu erkennen. Leider waren durch Sprengungen das Gestein und die an sich oft schon sehr zerbrechlichen Knochen in einem Zustand, der es mir nicht möglich machte die Knochen ohne weitere größere Beschädigung zu bergen. Daher beschloss ich einen Mitarbeiter des Universalmuseums Joanneum, Hr. Dr. Ingomar Fritz, über den Fund zu informieren. Der Kopfteil wurde tags darauf, unter der Leitung von Dr. Martin Gross, mit einem motorbetriebenen Winkelschleifer weitgehend erschütterungsfrei geborgen und befindet sich heute in der Dauerausstellung des Museums. Da es sich aber wie schon von mir vermutet, um ein ganzes Skelett handelte, wurde bei einem weiteren Bergungstag, mit großer maschineller Unterstützung von Seiten des Werkes, eine Bergung durch Dr. Fritz in meinem Beisein versucht. Leider war es nur möglich einzelne große Gesteinsbrocken mit Knochen zu bergen.

Dem Präparator Norbert Winkler (Joanneum), gelang es in mühevoller Kleinarbeit, Rippen und Wirbel freizulegen. Dabei fiel im auf, dass 7 Tigerhaizähne (*Galeocerdo aduncus*) zwischen den Knochenteilen eingebettet waren. Tigerhaizähne sind zwar immer wieder zu finden aber an sich eher selten in Retznei. Bei einem Besuch in Graz, konnte ich das Fundmaterial sehen. Gerne wurde mein Vorschlag aufgenommen, die auf Haie spezialisierte Mitarbeiterin des NHM Wien, Iris Feichtinger, darüber zu informieren. Eindeutig konnte sie die charakteristischen Bissspuren an einigen Rippen der Seekuh einer Tigerhaiattacke zuordnen. Es war der weltweit älteste Nachweis eines solchen Angriffs, der auch heute noch zwischen Tigerhaien und Seekühen zu beobachten ist. Publiziert wurden diese neuen Erkenntnisse 2021, unter Mitarbeit von Dr. Ingomar Fritz und Dr. Ursula Göhlich, im anerkannten Fachjournal *Historical Biology*. Neben weltweit wissenschaftlichem Interesse, errege dieser Fund auch großes mediales Interesse. In vielen Zeitungen, Internetforen und auch im steirischen Landesfernsehen wurde darüber berichtet. Scheinbar interessierte sich die Presse aber auch für den Finder, da nach einem netten Interview im Mai 2021 ein ganzseitiger Artikel im Standard über mich als Sammler im Zusammenhang mit dem Fund erschienen ist – „Vom wilden Hai gebissen“.

Dieser Fund soll nun nächstes Jahr in einer Sonderausstellung den Besuchern im Universalmuseum Joanneum präsentiert werden. Für die Presse und die Sonderausstellung hat ein verdientes ÖPG Mitglied, Hr. Fritz Messener, die Haiattacke in einem detailreichen Bild festgehalten.
Nie hätte sich vermutlich die junge Seekuh, und schon gar nicht zum Zeitpunkt der Haiattacke, träumen lassen, dass sie einmal so vielen Menschen Freude bereiten wird.

Hai Life in St. Pankraz - elasmobranch diversity from the Cretaceous to Eocene

JÜRGEN POLLERSPÖCK[1], IRIS FEICHTINGER[2,3], MATHIAS HARZHAUSER[2], GUILLAUME GUINOT[4] & SYLVAIN ADNET[4]

[1]Bavarian State Collection of Zoology; 81247 Munich, Germany.
[2]Natural History Museum Vienna, Burgring 7, 1010 Vienna, Austria
[3]University of Graz, NAWI Graz Geocenter, Institute of Earth Sciences, Austria
[4]Institut des Sciences de l'Evolution de Montpellier, CNRS, IRD, EPHE, Université de Montpellier; 34095 Montpellier, France.

The sediments of the vicinity of St. Pankraz near Salzburg are well-known for its extraordinary fossil richness. The most popular outcrop comprises sediments from the Eocene, yielding a diverse fossil content of invertebrates as well as scarce vertebrates. Among the vertebrates are remains of turtles, crocodiles, terrestrial- and marine mammals, and teleost fishes. The most diverse group of vertebrates, however, comprises elasmobranchs (sharks and rays). An intensive study of teeth from the deep-marine "Fossilschicht-layer" of the abandoned Schlössl Bruch enabled the re-evaluation and description of 37 shark and ray species from the middle Eocene (Lutetian). Considering the global scarcity of deep-water elasmobranchs during the middle Eocene warm period, this mesopelagic fauna fills a current gap in knowledge on elasmobranch diversity and faunal composition. A faunistic comparison between Eastern Atlantic, North Sea Basin and Tethyan communities further indicates homogeneity of deep-marine elasmobranch faunas during this period in Europe (Adnet et al. 2021).
In addition to the well-known and intensively studied Eocene sediments, this locality also bears a hitherto unknown Cretaceous elasmobranch fauna. The tectonically disturbed deep marine sediments crop out sporadically but provide a unique snapshot of elasmobranch diversity from the Late Cretaceous (Maastrichtian) of Austria on which we report our preliminary results.

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A lucky find - 325 million year old teeth represents the oldest sharks of Austria

IRIS FEICHTINGER[1,2], ALEXANDER O. IVANOV[3,4], VIOLA WINKLER[1], CLAUDIA DOJEN[5], RENÉ KINDLIMANN[6], JÜRGEN KRIWET[7], GUNNAR SCHRAUT[8] & SEBASTIAN STUMPF[7]

[1]Natural History Museum, Geological-Paleontological Department, 1010 Vienna, Austria
[2]University of Graz, NAWI Graz Geocenter, Institute of Earth Sciences, Austria
[3]Institute of Earth Sciences, St. Petersburg State University, St. Petersburg 199178, Russia
[4]Institute of Geology and Petroleum Technology, Kazan Federal University, Kazan 420008, Russia
[5]Landesmuseum Kärnten, Sammlungs und Wissenschaftszentrum, Liberogasse 6, 9020 Klagenfurt, Austria
[6]Haimuseum und Sammlung, Zürichstraße 58, 8607 Aathal-Seegräben, Switzerland
[7]University of Vienna, Department of Paleontology, Geozentrum, 1090 Vienna, Austria
[8]Herzog-Wolfgang-Straße 9c, 55590 Meisenheim am Glan, Germany

The fossil record of Chondrichthyes, or cartilaginous fishes, is strongly biased throughout the Palaeozoic in Austria. However, three exceptionally well-preserved teeth from the Carboniferous succession of Nötsch were found and recently donated to the Natural History Museum Vienna and the Landesmuseum Klagenfurt in Carinthia. While one tooth, *Cladodus gailensis,* protrudes from the siliciclastic rock matrix, an adjacent tooth, which is assignable to an unidentified member of the family Heslerodidae, remained completely covered by matrix. The third tooth, which could be identified as *Saivodus* cf. *striatus*, was also covered partially by matrix, which temporarily hid its genus-typical tooth characters until a micro-CT scan was prepared. The visualization of the teeth thus not only enabled the morphological description but also allowed the recognition of a hitherto unknown species, *C. gailensis*, and the documentation of the first record of the genus *Saivodus* in Central Europe.

In addition, we present a synopsis of the distribution and diversity of Carboniferous sharks based on primary literature. This comprehensive study indicates a distinct relationship between shark diversity and both major glaciation events during the Serpukhovian and Kasimovian, respectively. Although both extinction peaks of the North American realm were linked and followed by high diversification rates, marine Eurasian sharks seemingly struggled to cope with these drastic climatic and sea-level fluctuations in addition to continental reconfigurations. The freshwater sharks (Xenacanthiformes), on the other hand, immediately occupied new niches (river systems and lakes), which were provided by the ongoing deglaciation.

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The Vienna specimen of Plateosaurus – new implications for skeletal morphology and fossil behaviour

THOMAS FILEK[1], BEN PABST[2], ANNE LE MAÎTRE[3,4], MATTHIAS KRANNER[5] & URSULA B. GÖHLICH[5]

[1]Department of Palaeontology, University of Vienna, Althanstraße 14, 1090 Vienna, Austria

[2]Sauriermuseum Aathal, Zürichstrasse 69, 8607 Aathal-Seegräben, Switzerland.

[3]Department of Evolutionary Biology, University of Vienna, Althanstraße 14, 1090 Vienna, Austria.

[4]PALEVOPRIM – UMR 7262 CNRS INEE, Université de Poitiers, France.

[5]Department of Geology and Paleontology, Natural History Museum Vienna, 1010 Vienna, Burgring 7, 1010 Vienna, Austria.

The Triassic "prosauropod" *Plateosaurus* Meyer, 1837 is one of the most abundant dinosaurs in central European localities, especially in Germany, Switzerland, and France. The large number of these findings is of high importance because it corresponds to anearly occurrence of dinosaurs in the European area. In 2019 two partial skeletons excavated in Frick (Switzerland) were given on permanent loan to the Natural History Museum of Vienna. Through 3D scanning, printings of missing bones, and combining remains from both individuals, a complete specimen was casted, the so-called Vienna specimen of *Plateosaurus*. A detailed analysis of skeletal morphology was conducted on the available bones, especially the pelvis and tail. This firstly opens the possibility to distinguish between species and, secondly, creates the opportunity to achieve a better life reconstruction of *Plateosaurus*. Based on morphological, taxonomical and paleoethological approaches, we propose that there was at least two different *Plateosaurus* species in Frick, and that tail lashing could lead to lethal wounds. These results bring novel insights into this evolutionary important Late Triassic prosauropod species, laying further groundwork for multidisciplinary research.

Ecological zonation of the molluscan fauna of a late Pleistocene reef in southern Egypt, Red Sea

ANNA HAIDER[1,2], IVKIĆ, A.[1], KROH, A.[2], MANSOUR, A.[3] & ZUSCHIN, M.[1]

[1]University of Vienna, Department of Paleontology, Vienna, Austria

[2]Natural History Museum Vienna, Geological-Paleontological Department, Vienna, Austria

[3]South Valley University, Department of Geology, Luxor, Egypt

Many studies focus on modern coral reefs and their associated invertebrate fauna, but not much is known about the paleoecology and diversity of molluscs from Late Pleistocene coral reefs of the Red Sea, which were formed during the last interglacial (MIS5e). The focus of this study is on the molluscan assemblage of a Late Pleistocene coral reef in southern Egypt, at the locality Sharm El Luli, in Marsa Alam. The locality is characterized by a variety of reef- and reef associated habitats, including a reef flat, reef slope, a transition zone between the slope and the bay, a bay, shallow soft bottoms, and coral patches. We quantitatively and qualitatively sampled 10 sites with a total of 70 samples and collected 2126 shells. 177 taxa were recognized, 61 bivalve species (17 families) and 116 gastropod species (32 families). The qualitative sampling approach revealed a higher diversity than the quantitative approach. The most abundant bivalve taxon was the epifaunal, encrusting *Chama* spp., the most abundant gastropod species was the cerithiid *Rhinoclavis vertagus*. Most bivalve species are infaunal filter feeders, while most gastropods are epifaunal carnivores. The diversity is highest in the coral patch and the reef top. Preliminary statistical results suggest two main environments: Reef associated hard- and soft bottoms. Hard substrata (reef flat, reef slope) are best characterized by encrusting taxa such as *Chama* spp. and *Spondylus* spp., and by *Tridacna maxima* and *Periglypta* sp., both well-known reef associates. Gastropods in this environment are predatory conids and cypraeids. All these species live today on – or occur cryptically in – structured hard bottoms. Reef associated-soft bottom environments – bay, shallow soft bottom, and soft bottoms around coral patches – are best characterized by infauna, such as the tellinid Q*uidinipagus palatam* and the lucinids *Anodontia kora* and *Pillucina vietnamica*. Many soft bottom gastropod species such as the strombid *Gibberulus gibberulus albus*, the cerithiid *Rhinoclavis vertagus*, both with an herbivorous diet, and the nassariid *Nassarius fenistratus*, a scavenger, can be found here. A comparison with modern datasets from the Red Sea indicates strong similarities in faunal composition and habitat diversity between fossil and recent reefs. Furthermore, our results suggest that Late Pleistocene molluscan assemblages can aid in reconstruction of fossil reefs and reef-associated habitats.

Back to the sea - inner ears reveal ecomorphological adaptations in thalattosuchian crocodylomorphs

JULIA A. SCHWAB[1], MARK T. YOUNG[1], JAMES M. NEENAN[2], STIG A. WALSH[3], LAWRENCE M. WITMER[4], YANINA HERRERA[5], CHRISTOPHER A. BROCHU[6], JONAH N. CHOINIERE[7], ALAN H. TURNER[8] & STEPHEN L. BRUSATTE[1]

[1]University of Edinburgh, Edinburgh, U.K.
[2]Oxford University Museum of Natural History, Oxford, U.K.
[3]National Museum of Scotland, Edinburgh, U.K.
[4]Ohio University, Athens, Ohio, U.S.A.
[5]CONICET, División Paleontología Vertebrados, Museo de La Plata, La Plata, Argentina
[6]University of Iowa, Iowa City, Iowa, U.S.A.
[7]University of the Witwatersrand, Johannesburg, South Africa
[8]Stony Brook University, Stony Brook, New York, U.S.A.

A prime example of a major evolutionary transition are thalattosuchian crocodylomorphs. Known from the Early Jurassic to the Early Cretaceous, they evolved from terrestrial ancestors into the first radiation of marine crocodylomorphs. Basal thalattosuchians were semiaquatic, with a gharial-like body-plan, and are known from freshwater, brackish and coastal marine environments. However, the metriorhynchid sub-group radically modified their bauplan during their transition to an obligately pelagic lifestyle. This included evolving paddle-shaped limbs, a vertically orientated tail fluke, and smooth skin lacking scales and osteoderm 'armour'. While these osteological changes are well understood, little is known about how their neurosensory systems evolved during this transition. Cranial sensory organs are powerful ecological proxies, for example the inner ear, which is involved in hearing, equilibrium, balance, and head stabilisation. The vestibular system of the inner ear includes the three semicircular canals and the vestibule, and studies across a wide range of vertebrates show that inner ear morphology correlates with animal behaviour and lifestyles.

Based on computed tomography scans and three-dimensional bony labyrinth models of a broad sample of fossil and extant crocodylomorph taxa, we studied changes in the morphology of the inner ear vestibular system during the thalattosuchian land-to-sea transition. We found that the vestibular system changes significantly as crocodylomorphs moved from terrestrial to open ocean environments. Pelagic thalattosuchians (metriorhynchids) had dorsoventrally shorter labyrinths with wider semicircular canals and an enlarged vestibule compared to their terrestrial ancestors. This pelagic inner ear morphology evolved after the radical osteological changes to the postcranial skeleton, suggesting changes to sensory systems lag behind osteological ones during major evolutionary transitions. This parallels trends seen in other marine vertebrates, suggesting a common pathway for pelagic reptiles to adapt to marine life and a strong correlation between aquatic lifestyle and semicircular canal morphology.

Changing paleobathymetry and paleoenvironments in the Austrian Vienna Basin during the early and middle Miocene

MATTHIAS KRANNER[1], MATHIAS HARZHAUSER[1], OLEG MANDIC[1], PHILIPP STRAUSS[3], WOLFGANG SIEDL[3], WERNER E. PILLER[2]

[1]Natural History Museum Vienna, Geological-Palaeontological Department, Burgring 7, 1010 Vienna, Austria
[2]University of Graz, NAWI Graz Geocenter, Institute of Earth Sciences, Heinrichstr. 26, 8010 Graz
[3]OMV Exploration and Production GmbH, Trabrennstraße 6-8, 1020 Vienna, Austria

The Neogene Vienna Basin (VB) is a major hydrocarbon province with a long history of exploration accumulating extensive stratigraphic and structural information from numerous seismic and drilling programs. The VB is composed of several horst and graben structures forming different subbasins, each with its own geodynamic evolution and deviating paleobathymetric and paleoenvironmental developments during the Miocene. We present an analysis of water depth and paleoenvironmental evolution along a NE-SW transect based on analyses of benthic and planktic foraminifers of hundreds of samples derived of 52 drillings. We document dramatic changes in the depth profile through time, which coincide with shifts of prevailing tectonic regimes. Bathyal conditions were established during the early Miocene piggy-back stage and the early middle Miocene extensional phase. A clear shallowing trend from upper bathyal to inner neritic conditions occurred during the middle Miocene extensional tectonic phase.

Further, our analyses comprise reconstructions of sea surface temperature (SST), bottom water temperature (BWT), salinity, trophic levels, stress indicators, mode of life, feeding preferences and diversity indices (Fisher α, dominance and equitability).

Bottom water temperatures indicate cooling during the early and middle Badenian (Langhian), which seemingly contradicts the global warming of the Middle Miocene Climatic Optimum (MMCO) and a subsequent warming, which contrasts the expected trend following the cooling of the Middle Miocene Climatic Transition. Both trends are discussed as result from bathymetric evolution of the VB and intense upwelling during the early and middle Badenian. All lowstand systems of relative sea level in the VB coincide with global Mi-events. The observed maxima of the relative sea level in the VB are vaguely in phase with the global record from the Ottnangian (late early Miocene) to the middle Badenian (middle Miocene) but exceed the range of global sea level rise by three to four times, suggesting a strong tectonic amplification.

Evolutionary history and dental variation in tiger sharks (Chondrichthyes, *Galeocerdo*)

JULIA TÜRTSCHER[1], FAVIEL A. LÓPEZ ROMERO[1], PATRICK L. JAMBURA[1], RENÉ KINDLIMANN[2], DAVID J. WARD[3], KEIICHI SATO[4],TAKETERU TOMITA[5] & JÜRGEN KRIWET[1]

[1]University of Vienna, Department of Palaeontology, 1090 Vienna
[2]Haimuseum und Sammlung R. Kindlimann, Aathal-Seegräben, Switzerland
[3]Department of Earth Sciences, The Natural History Museum London
[4]Okinawa Churashima Research Center, Motobu-cho, Okinawa, Japan
[5]Okinawa Churaumi Aquarium, Motobu-cho, Okinawa, Japan

Sharks possess a lifelong tooth replacement, which has led to their fossil record comprising mostly isolated teeth rather than complete skeletons. Dental traits therefore represent important characters for species identification and to reconstruct phylogenetic interrelationships. Tiger sharks (*Galeocerdo*) are known since the early Eocene (ca. 56 Ma) and include several ambiguous extinct species only known from isolated teeth. The seemingly complex fossil record of Galeocerdo resulted in an unresolved and controversial evolutionary history of this genus. Possible heterodonties (i.e., exhibition of different tooth morphologies) and incomplete dental descriptions represent additional challenges in unravelling open questions on the evolutionary and developmental history of tiger sharks.

Here, we present a comprehensive revision of the fossil record of tiger sharks as well as thorough descriptions of different tooth shapes occurring across ontogeny in the modern tiger shark *Galeocerdo cuvier*. We used landmark-based 2D geometric morphometrics on teeth of different tiger shark species to quantify intra- and interspecific tooth shape variation and to analyse the presence or absence of possible heterodonties. Our results allow us to reinterpret the fossil record of *Galeocerdo* by re-assessing several species and thus reducing the number of valid taxa from 23 to four valid species. Moreover, a weak but noticeable ontogenetic heterodonty in extant tiger sharks was detected. Besides providing a better understanding of the evolutionary history of the tiger shark group, our data helps elucidating the underlying developmental and evolutionary processes behind the dental diversity in sharks today and in deep time.

On the origin of the great white shark *Carcharodon carcharias*

PATRICK L. JAMBURA[1], JULIA TÜRTSCHER[1], RENÉ KINDLIMANN[2], DAVID OFFENBERGER[1], CATALINA PIMIENTO[3] & JÜRGEN KRIWET[1]

[1]University of Vienna, Department of Palaeontology, 1090 Vienna
[2]Haimuseum und Sammlung R. Kindlimann, Aathal-Seegräben, Switzerland
[3]University of Zurich, Palaeontological Museum, Zurich, Switzerland

The great white shark *Carcharodon carcharias* is known since the late Miocene, a period in which a number of big lamniform sharks occurred, i.e., †*Otodus megalodon*, †*Cosmopolitodus hastalis* and †*Carcharodon hubbelli*. The evolutionary origin of the great white shark remains highly debated and two hypotheses have been proposed: (1) C. carcharias is closely related to the megatoothed sharks, including †*O. megalodon*; (2) *C. carcharias* shares a more recent common ancestor with mako sharks (*Isurus*) and descended from the broad toothed mako shark †*C. hastalis* (Ehret et al., 2012). Unfortunately, sharks exhibit a fossil record that mainly consists of isolated teeth due to their poorly mineralized cartilaginous endoskeleton, hampering comprehensive phylogenetic analyses and thus the reconstruction of their evolutionary history.

Here we report of an exceptional find of two well preserved shark skeletons of a juvenile (TL ~1.7m) and an adult (TL ~5m) †*Cosmopolitodus hastalis* from the late Miocene Pisco Formation of Peru. We conducted a phylogenetic analysis (with a molecular backbone constraint) based on previously published dental characters for lamniform sharks (Shimada, 2005). Additionally, morphometric analyses were performed to visualize the morphospace occupation of Isurus, †*Cosmopolitodus* and *Carcharodon*. Our combined approach allowed us to reconstruct the evolutionary history of *Carcharodon carcharias* and the dental transition from fossil mako sharks to the extant great white shark, and thus strongly favours the hypothesis that *Carcharodon carcharias* descended from broad toothed mako sharks.

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