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Book of Abstracts of the XXII Annual Meeting of the European Association of Vertebrate Palaeontologists, 30 June–5 July 2025, Kraków, Poland

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Book of Abstracts

Edited by

Georgios L. Georgalis, Tomasz Sulej, Matteo Belvedere & Marcelo R. Sánchez-Villagra

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The logo of our Meeting depicts: the Woolly Rhinoceros *Coelodonta antiquitatis* (which is the most famous specimen from Starunia and is exhibited in the Natural History Museum of the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences (ISEA PAS), Kraków, being also the logo of the ISEA PAS); the large snake *Palaeopython*; the trionychid turtle *Axestemys*; and the temnospondyl *Metoposaurus*. The logo was made by Jakub Zalewski.

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A diverse snake fauna from the Plio-Pleistocene of Athens, Greece. *[Poster]*

CECILIA LODDI, Andrea Faggi, Saverio Bartolini Lucenti & Lorenzo Rook
Scratching the surface: preliminary results of TDMA (Total Dental Microwear Analysis) to discriminate ecological groups in extant and fossil canids (Carnivora, Canidae). *[Talk]*

PRISCILA LOHMANN, Dimila Mothé & Luca Pandolfi

Ciao, *Anancus*! New dental remains of a tetralophodont gomphothere (Mammalia, Proboscidea) takes its bite into Italy's latest Miocene/early Pliocene fossil record. *[Poster]*

VÍCTOR LÓPEZ-ROJAS, Miguel Moreno-Azanza & Eduardo Puértolas-Pascual

Hidden clues in phytosaur lower jaws – a phylogenetic significance on the post-dentary mandible bones. *[Talk]*

SERGI LÓPEZ-TORRES, Marcin Górka, Adrian Marciszak, Yohan Pochat-Cottilloux, Paweł Socha, Krzysztof Stefaniak & Mateusz Tałanda

New ape material (Primates, Hominoidea) from the Middle Miocene of Silesia, Poland. *[Poster]*

SERGI LÓPEZ-TORRES, Deming Yang, Fredrick Kyalo Manthi & Ashley S. Hammond

New lorisoids (Primates, Strepsirrhini) from the Late Miocene Lemudong'o Formation, southern Kenya. *[Talk]*

LOREDANA MACALUSO, Ane Elise Schrøder, Jonathon Leonard, Hendrik Müller, Davit Vasilyan, Márton Rabi, Philip B. Holden, Sabin Zahirovic & Roberto Rozzi

Batrachosauroidid, amphiumid, and sirenid salamanders (Urodela): an example of greenhouse-driven convergent morphology. *[Talk]*

JOAN MADURELL-MALAPEIRA, Saverio Bartolini-Lucenti, Ilaria Meli, Darío Fidalgo, Narimane Chatar, Alberto Boscaini, Margot Michaud, Alexander Lavrov, Qigao Jiangzuo, Francisco Prevosti, Justin Adams, Camille Thabard, Jean Baptiste Fourvel, Nikolai Spassov, Denis Geraads & Lorenzo Rook

Neuroanatomy of sabertoothed cats (Carnivora, Felidae): insights into social and sensory behaviour. *[Talk]*

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A new plesiosaur from the Toarcian of Holzmaden sheds light on plesiosauroid diversity in the Early Jurassic European epeiric seas. *[Poster]*

ELISABETE MALAFAIA, Alberto Cabezuelo-Hernández & Adán Pérez-García

New squamate specimens from the Kimmeridgian Guimarota fossil site (Portugal). *[Poster]*

PHILIP D. MANNION & Andrew J. Moore

The evolutionary relationships and biogeographic history of diplodocoid sauropod dinosaurs. *[Talk]*

LORENZO MARCHETTI, Matteo Belvedere, Valerio Granata & Alberto Collareta

A dinosaur-dominated ichnoassociation from the lower Upper Triassic of Northern Italy: testing the impact of the Carnian Pluvial Episode on the terrestrial faunas. *[Talk]*

LORENZO MARCHETTI, Antoine Logghe, Michael Buchwitz, Arnaud Rebillard & Jörg Fröbisch

Exceptional tetrapod body impressions and scaly skin traces from the early Permian Bromacker locality (Thuringia, Germany). *[Talk]*

DOMENICO MARCHITELLI, Andrea Villa, Loredana Macaluso, Marco Pavia, Romala Govender & Massimo Delfino

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ADRIAN MARCISZAK, Grzegorz Lipecki & Mieczysław Wolsan

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DAVID MARJANOVIĆ

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CARLOS MARTINEZ-PEREZ, Philip C.J. Donoghue, Bogdan Jurkovšek, Katja Oselj, Castor Almañanzas-Alpuente & Tea Kolar-Jurkovšek

Apparatus stability in *Pseudofurnishius murcianus* (Conodonta) reveals gondolellid evolutionary conservatism. *[Talk]*

ROBERTA MARTINO, Carolina Di Patti, Maria Ríos, Lorenzo Rook, Mirko Di Febbraro, Pasquale Raia & Luca Pandolfi

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TOBIAS MASSONNE & Felix J. Augustin

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Red fox *Vulpes vulpes* (Linnaeus, 1758) and Arctic fox *Vulpes lagopus* (Linnaeus, 1758) from South Moravian sites of the Late Pleistocene - analysis of bone remains from Pavlov I and Dolní Věstonice I sites. *[Talk]*

ERIN E. MAXWELL & Samuel L.A. Cooper

Exploring early diversity in pachycormid fishes. *[Talk]*

ILARIA MELI, Joan Madurell-Malapeira, Saverio Bartolini-Lucenti & Lorenzo Rook

First neuroanatomical description of *Megantereon cultridens* (Carnivora, Felidae) in comparison with extant felids. *[Talk]*

CHRISTIAN ANDREAS MEYER, José Hugo Heymann, Alfonso Alem Rojo, Dorothee Hippler, Ricardo Cespedes Paz, Ismar de Souza Carvalho & Lara Sciscio

A reappraisal of the iconic ankylosaur trackway *Ligabueichnium bolivianum* Leonardi from the Late Cretaceous (Maastrichtian) of Bolivia (El Molino Formation, Parque Nacional de Toro Toro, Bolivia) - Facts and fiction. *[Talk]*

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A geometric morphometric approach for the identification of isolated pubic bones of marine reptiles from the Muschelkalk of the Germanic Basin: preliminary results. *[Poster]*

FEIKO MIEDEMA, Torsten M. Scheyer, Dylan Bastiaans, Stephan N.F. Spiekman, Dave Spiller & Nicole Klein

The cranium of the enigmatic Triassic reptile *Eusaurosphargis* from a new specimen from Winterswijk, the Netherlands, and implications for sauropterygian evolution. *[Talk]*

RAEF MINWER-BARAKAT, Arnau Bolet, Antonio García-Alix, Elvira Martín-Suárez & Matthijs Freudenthal

Early Ruscinian small vertebrates from Yeguas (Guadix Basin, Southern Iberian Peninsula). *[Poster]*

RAEF MINWER-BARAKAT, Judit Marigó & Matthijs Freudenthal

Late Eocene Primates from Sierra Palomera (Spain). *[Poster]*

JAVIER MORA & Josep Fortuny

Postcranial skeleton of the capitosaur *Calmasuchus acri* (Temnospondyli) from the Anisian (Middle Triassic) of the Catalonian Basin (NE Iberian Peninsula). *[Poster]*

FEDERICA MULÈ, Florent Rivals, Giovanni Bianucci & Luca Pandolfi

Inside the proboscidean mouth: preliminary report on dental microwear analysis of Pliocene and lowermost Pleistocene species from Tuscany (central Italy). *[Poster]*

PAWEŁ MUNIAK & Łucja Fostowicz-Frelik

μCT scans reveal new information about dental replacement in the superfamily Djadochtatherioidea (Mammalia, Multituberculata). *[Poster]*

CECILY S.C. NICHOLL, Diego Pol & Philip D. Mannion

A new notosuchian (Crocodylomorpha) phylogeny reveals the complex evolutionary history of sebecids. *[Talk]*

GRZEGORZ NIEDŹWIEDZKI & Per E. Ahlberg

The Middle Devonian tetrapod trackways predating their body fossil finds. *[Talk]*

FRANCESCO NOBILE, Alberto Collareta, Eliana Fornaciari, Luca Giusberti, Vittore Perenzin & Giovanni Bianucci

A new Lower Miocene marine mammal assemblage from the Colle della Croce quarry (Feltre, northeastern Italy) and new biostratigraphic insights on the age of the Libàno Sandstone). *[Talk]*

PIERRE ORGEBIN, Alexandra A.E. van der Geer, George Lyras, Bastien Mennecart, Grégoire Métais & Roberto Rozzi

Virtual endocast of *Hoplitomeryx matthei* (Artiodactyla, Hoplitomerycidae) and brain evolution in insular ruminants. *[Talk]*

KATJA OSELJ, Luka Gale, Tea Kolar-Jurkovšek, Bogdan Jurkovšek & Carlos Martínez-Pérez

Ontogenetic changes and occlusal efficiency in conodonts. *[Talk]*

OLIWIA OSZCZEPALIŃSKA, Florent Rivals & Nina Kowalik

Short-term dietary patterns in woolly rhinoceros (*Coelodonta antiquitatis*): insights from Starunia and surrounding regions. *[Talk]*

OLIWIA OSZCZEPALIŃSKA, Martina Roblíčková, Anna-Kaisa Salmi & Kjetil Lysne Voje

Osteometric variability in Late Pleistocene reindeer (*Rangifer tarandus*) from Moravia. *[Poster]*

KRZYSZTOF OWOCKI, Hervé Bocherens & Grzegorz Niedźwiedzki

How to survive a winter? Life and death of *Tarbosaurus bataar* (Dinosauria, Theropoda) from the Late Cretaceous ecosystems of Asia. *[Talk]*

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New insights into Anatolian snake fauna at the Paleogene–Neogene transition. *[Poster]*

GRZEGORZ PACYNA, Anna Fijałkowska-Mader & Tomasz Sulej

Palaeoenvironment and trophic structure of the Late Triassic vertebrate-bearing Poręba site (Upper Silesia, Poland). *[Talk]*

LUCA PANDOLFI, Mirko Di Febbraro, Pasquale Raia & Roberta Martino

Unveiling postcranial variability in the extinct Sicilian *Hippopotamus*: implications for taxonomy and palaeoecology. *[Talk]*

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The most complete cranial anatomy of a fossil ginglymodian revealed by a new fish specimen from the Late Triassic of Krasiejów (Poland). *[Talk]*

KAMILLA PAWŁOWSKA, Kajetan Dedła, Zofia Pogoda, Roman Croitor, Thijs van Kolfschoten, Diego Jaime Alvarez Lao, & Vlad Codrea

Images of woolly rhinoceroses in Paleolithic art in Eurasia. *[Poster]*

ROMAIN PELLARIN, Isabelle Vallet, Georges Gerolymos & Eric Brunet

Thermal palaeobiophysics: body temperature inferences for *Thalattosuchus superciliosus* (Crocodylomorpha, Thalattosuchia). *[Poster]*

MACIEJ K. PINDAKIEWICZ, Krzysztof Hryniewicz, Simona Rinkevičiūtė, Przemysław Sztajner, Katarzyna Janiszewska & Andrzej Kaim

Jurassic teleost diversity and abundance changes, recorded by otolith and cephalopod statolith assemblages. *[Talk]*

JOANNA PIWOWARCZYK, Wojciech Pawlak & Mateusz Tałanda

Structure and functions of the teeth of the Triassic reptile *Nothosaurus* (Sauropterygia). *[Poster]*

YOHAN POCHAT-COTTILLOUX, Marcin Górka, Sergi López-Torres & Mateusz Tałanda

Updating the Miocene Polish fossil record: new terrestrial vertebrate localities from the Serravallian (Middle Miocene) of the Holy Cross Mountains. *[Talk]*

YOHAN POCHAT-COTTILLOUX, Gwendal Perrichon, Lionel Hautier, Nicolas Rinder, Romain Amiot, Irena Raselli, Jérôme Adrien, Joël Lachambre, Vincent Fernandez & Jeremy E. Martin

Size is the major driver of the endosseous labyrinth shape in extant crocodylians. *[Poster]*

TOMASZ POSTAWA

Can heterothermic species be used as indicators of environmental changes? A test using Holocene bat faunas from Poland. *[Poster]*

Derek Hoffman, Alyson A. Brink, George Phillips, Logan King, James Starnes, Nina L. Baghai-Riding, Carol L. Hotton, Olivia Pharr, Dave Hanes & **ALBERT PRIETO-MÁRQUEZ**

An Appalachian early-branching hadrosaurid dinosaur (Dinosauria, Ornithopoda) from the lower–middle Campanian Coffee Formation of Mississippi, southeastern USA. *[Poster]*

Marta Meléndez, Natalia Jagielska, Albert Sellés, Heather Middleton & **ALBERT PRIETO-MÁRQUEZ**

Osteohistology of pterosaur specimens from the Kimmeridge Clay Formation (Upper Jurassic) of Weymouth, UK. *[Poster]*

ARNAUD REBILLARD, Vincent Dupret, Pavel Beznosov & Per Erik Ahlberg

Investigating a Devonian vertebrate assemblage with Synchrotron Microtomography of coprolites. *[Talk]*

JOANNA RELIGA-SOBCZYK, Piotr Wojtal, Nina Kowalik, Sylwia Pospuła, Lembi Lõugas, Christoph Spötl, Teresa Tomek & Krzysztof Wertz (Zooarchaeological and isotopic study of animal remains from the Late Bronze Age site of Ridala, Saaremaa Island, Estonia). *[Talk]*

RICCARDO ROCCHI, Filippo Maria Rotatori, Gabriel S. Ferreira & Federico Fanti

3D-*ysalotosaurus*: revealing the life history of an early-diverging iguanodontian dinosaur (Ornithopoda). *[Talk]*

MACIEJ RUCIŃSKI, Petter Nordenhaug, Lena Libe Delsett & Mathieu Gabriel Faure-Brac

The unique fossilization pattern in a Middle Triassic mixosaurid (Ichthyosauria). *[Poster]*

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The osteology and taxonomic status of the first described tanystropheid – *Tanystropheus conspicuus* von Meyer, 1852 (Reptilia, Archosauromorpha). *[Talk]*

Jorge D. Carrillo-Briceño, Tomáš Suchánek, Rodolfo Salas Gismondi, Donald Stewart; Robert Cerny, Torsten M. Scheyer, John J. Flynn, Pierre-Olivier Antoine & **MARCELO R. SÁNCHEZ-VILLAGRA**

A polypterid fish from the Miocene of Peru. *[Talk]*

TIM SCHUURMAN, Emiliano Bruner & Fabien Knoll

Sauropodomorph (Dinosauria) cranial topology: a comparative anatomical network analysis. *[Talk]*

DANIELA SCHWARZ, Verónica Díez Díaz, Amy Campbell, Wilson Jilala Viscent & Pastory M. Bushozi

A new look at the dinosaur diversity of the Tendaguru Formation in Tanzania. *[Poster]*

LARA SCISCIO, Sergei Lazarev, Lilit Sahakyan & Davit Vasilyan
The first avian tracks from Armenia's Mio-Pliocene transition. *[Talk]*

ALBERT SELLÉS, Bernat Vila, Verónica Díez Díaz & Jean Le Loeuff
Ecological niche partitioning in European titanosaurs (Dinosauria, Sauropoda): data from the lower jaw morphology. *[Talk]*

Salvador Giró, Angel Galobart & **ALBERT SELLÉS**
Deep-learning in Palaeontology: a Convolutional Neural Network approach to dinosaur eggshell identification. *[Poster]*

Xavier Panadès i Blas, Àngel Galobart & **ALBERT SELLÉS**
A review of the Cenozoic fossil record of avian eggs, eggshells, and nests. *[Poster]*

GIOVANNI SERAFINI, Jürgen Kriwet, Tommaso Toldo, Eliana Fornaciari, Jacopo Amalfitano & Giorgio Carnevale
An enigmatic longirostrine fish (Teleostei, Tselfatiiformes) from the Upper Cretaceous of Northern Italy pushes the boundaries of evolutionary convergence in Teleostei). *[Talk]*

GIOVANNI SERAFINI, Eudald Mujal, Daniel Madzia & Ursula Thun Hohenstein
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REBECCA SHENG, Dana Korneisel, Grzegorz Niedzwiedzki & Per Erik Ahlberg
New end-Devonian early tetrapod material from Greenland. *[Talk]*

JUSTYNA SŁOWIAK & Tomasz Szczygielski
Allometric growth in Tyrannosauridae (Dinosauria, Theropoda). *[Talk]*

KRISTER T. SMITH
The taphonomy and biodiversity of the Eocene Messel Pit. *[Invited lecture]*

GABRIELA SOBRAL & Martin D. Ezcurra
Inferences on the palaeobiology of the early archosauromorph *Prolacerta broomi*. *[Talk]*

MACIEJ STRUSKI
The wolf is full, and the hyena is gone – the causes of the extinction of the cave hyena *Crocuta crocuta spelaea* (Goldfuss, 1823) in Europe. *[Poster]*

Dawid Dróżdż, Tomasz Szczygielski & **TOMASZ SULEJ**
Limb anatomy of the aetosaur *Stagonolepis olenkae* (Aetosauria, Stagonolepididae)). *[Talk]*

DAWID SURMIK, Monika Malicka, Katarzyna Zaremba-Niedźwiedzka, Paweł Dąbczyński, Alicja Staniek & Grzegorz Niedźwiedzki
Proteolytic fungal activity in remains of soft tissues preserved in over 200-million-years-old theropod bones. *[Poster]*

Aleksander Białka, **DAWID SURMIK** & Aleksander Lamża

Applying machine learning to identify biological structures in demineralized fossil bone samples. *[Poster]*

DOMINIK ŚWIĄTEK

Did temnospondyls get outcompeted to extinction by phytosaurs during the Triassic?. *[Poster]*

PRZEMYSŁAW ŚWIŚ, Krzysztof Broda, Weronika Łaska, Dawid Dróżdż & Piotr Duda

The apparatus composition of the *Ctenopolygnathus brevilaminus* (Conodonta) based on the natural assemblage from the Devonian of the Holy Cross Mountains, Poland. *[Poster]*

PRZEMYSŁAW ŚWIŚ, Bryan Shirley & Emilia Jarochowska

The ontogeny of the Late Devonian conodont *Tripodellus gracilis* based on growth increments. *[Talk]*

BARBARA SZAFRON, Carl Mehling & Andre Saleiro

Taming a Mesozoic Menagerie: spatial documentation strategies for a complex fossil site. *[Talk]*

MATEUSZ TAŁANDA, Vincent Fernandez, Evelyn Kustatscher & Roger Benson

Synchrotron tomography reveals new anatomical data on the early lizard *Megachirella. [Talk]*

ELŻBIETA M. TESCHNER

Growth pattern variability among Late Triassic pseudosuchians (Reptilia, Archosauria). *[Talk]*

ELŻBIETA M. TESCHNER, Andrea Prino & Dorota Konietzko-Meier

Palaeohi(p)stology – first analysis of the pelvic elements of *Metoposaurus krasiejowensis* (Temnospondyli, Metoposauridae). *[Poster]*

Mateusz Antczak, Jakub Kowalski & **ELŻBIETA M. TESCHNER**

Occulta apparentia: coelacanthiform fish remains from the Late Triassic deposits of Krasiejów, Poland. *[Poster]*

ROBERTA VAKRUCHEV, Sifra Bijl, Jordi Estefa, François Clarac, Jasper Ponstein, Paul Tafforeau, Anusuya Chinsamy-Turan & Sophie Sanchez

Surface analysis of the proximal epiphyseal growth plate in the humeri of mammals. *[Talk]*

IVO VAN DER BEEK, Djurre van der Molen, Carlos Martinez-Perez, Anne Schulp, Femke Holwerda & Emilia Jarochowska

Using artificial intelligence for 2D dental microwear analysis of European Middle Triassic marine vertebrates. *[Talk]*

ȘTEFAN VASILE & Márton Venczel

The first report of an Early Pliocene cryptobranchid amphibian (Urodela) from eastern Romania. *[Poster]*

FRAN VIDAKOVIĆ, Andrzej S. Wolniewicz, Aleksandar Mezga, Dražen Japundžić, Robert Šamarija, Tea Kolar-Jurkovšek & Daniel J. Field

The first Middle Triassic ichthyopterygian (Reptilia, Diapsida) from Croatia. *[Poster]*

BERNAT VILA, Albert Sellés & Agustín G. Martinelli

Review of *Antarctosaurus wichmannianus* (Sauropoda, Titanosauria) from the Late Cretaceous of Patagonia: insights into the osteology and histology. *[Poster]*

BERNAT VILA, Albert Sellés & Giancarlo J. Olmedo

A gigantic long-necked titanosaur (Dinosauria, Sauropoda) from the Late Cretaceous of Ibero-Armorica (SW Europe). *[Talk]*

BERNAT VILA, Albert Sellés & Xabier Pereda-Suberbiola

Osteohistological analysis of appendicular elements referred to *Lirainosaurus astibiae* (Sauropoda, Titanosauria) from the Laño locality (Iberia). *[Poster]*

Bernat-Josep Vázquez López, **BERNAT VILA** & Albert Prieto-Márquez

A reassessment of traditional 2D microwear analysis and its application to dinosaur teeth. *[Poster]*

NICOLAS WAGNER, Narimane Chatar & Jesse Hennekam

Investigating functional variation in proboscidean limb morphotypes with finite element analysis under compression. *[Poster]*

KACPER WĘGRZYN, Krister T. Smith, Alessandro Palci, Oliver Wings, Márton Rabi, Roberto Rozzi & Georgios L. Georgalis

A new skeleton of the booid snake *Eoconstrictor barnesi* (Serpentes, Constrictores) from the Eocene Konservat-Lagerstätte of Geiseltal, Germany. *[Poster]*

Tomasz Szczygielski, **KACPER WĘGRZYN**, Justyna Słowiak & Dawid Surmik

Report of multi-causal shell abnormalities in the of the Late Cretaceous turtle *Mongolemys elegans* (Testudines, Pan-Testudinoidea). *[Poster]*

ŁUKASZ WERYŃSKI & Błażej Błażejowski

New finds of Late Jurassic vertebrates from Owadów-Brzezinki site, central Poland. *[Talk]*

ŁUKASZ WERYŃSKI & Bogusław Kołodziej

The first occurrence of *Strophodus* (Chondrichthyes, Hybodontiformes) in the Jurassic of southern Poland: iron-mediated taphonomy of tooth histology. *[Poster]*

WIKTORIA WIELICZKO, Sergi López-Torres & Justyna Słowiak

Endocranial morphology of dome-headed dinosaurs (Dinosauria, Pachycephalosauria). *[Poster]*

JAROSŁAW WILCZYŃSKI, Martin Novák & Marc Händel

Mammoth bone accumulations in Central Europe – notes in the margin of the ERC MAMBA project. *[Talk]*

OLIVER WINGS, Joschua Knüppe, Michael Arnold & Christian Bartel
"Jurassic Europe": Transferring science with a new interactive media station. *[Talk]*

MARCELI WITASIK, Paweł Bącal, Krzysztof Stefaniak & Justyna Słowiak
The dietary preferences of the titanosaur *Nemegtosaurus mongoliensis* (Dinosauria, Sauropoda). *[Poster]*

PIOTR WOJTAL & Jarosław Wilczyński
Man and woolly mammoth at the Kraków Spadzista (Poland) – taphonomy of the site. *[Talk]*

ANDRZEJ S. WOLNIEWICZ, Evelyn Kustatscher & Baran Karapunar
An Early Triassic saurosphargid (Reptilia, Sauropterygomorpha) from the Italian Dolomites. *[Talk]*

JUANA YAÑEZ-SEOANE, Tomasz Sulej, Mateusz Tałanda, M. Belén von Baczko & Julia B. Desojo
First palaeoneurological studies of the Polish aetosaur *Stagonolepis olenkae* (Aetosauria, Stagonolepididae) from the Upper Triassic Grabowa Formation, Poland. *[Poster]*

JAKUB ZALEWSKI (New occurrences of Plagiosauridae (Temnospondyli) show a more complex pattern of decline for this group). *[Poster]*

SIYAN ZHAO, Jiachun Li & Zuoyu Sun
Reconstruction of the three-dimensional dental vascular system of Synechodontiformes from the Late Permian to the Middle Triassic of China, with remarks on the pseudopolyaulacorhize vascularization. *[Talk]*

Abstracts

[Poster] [non-student]

Playstocene - a board game about palaeobiodiversity and climate change

Isacco Alberti[1,2,*], Francesca Borchi[1,2], Vincenzo Gesualdi[1], Silvia Danise[1,2] & Matteo Belvedere[1,2]

[1] Dipartimento di Scienze della Terra, Università di Firenze, Florence, Italy;

[2] NBFC, National Biodiversity Future Center, Palermo, Italy;

[*] isacco.alberti@unifi.it – presenting author

Keywords: Gamification, education, Pleistocene, boardgames, climate change.

Can the rules of a board game marry with scientific concepts?
Playstocene is an educational board game set during the glacial and interglacial cycles of the Pleistocene, in which the animal species that inhabited Italy struggle for survival amidst climate change, environmental transitions, and extinctions. The game conceptualisation involved several figures like palaeontologists, palaeopalynologists, museum curators, boardgame developers, and palaeoartists, to develop an engaging way to explore the biodiversity of the past and better understand the delicate balances of the present world.
In the game, players take on the role of a member of the Pleistocene mammal fauna of Italy belonging to the category of herbivores (e.g. *Mammuthus meridionalis*, *Pseudodama farnetensis*, *Stephanorhinus etruscus*) and carnivores (e.g. *Panthera gombaszoegensis*, *Pachycrocuta brevirostris*, and *Homotherium crenatidens)* and have to achieve an objective while surviving a series of natural events and environmental changes requiring them to adapt. Intended for audiences aged 10 +, Playstocene aims at teaching about the biology of extinct species in an amusing way, imprinting deep concepts and dynamics like palaeoclimatology, adaptation, natural selection, ecological niches, prey-predator ratio, and climate change. Boards have been designed for each species, with their specific name, a palaeoartistic reconstruction, and information on their mode of life that are useful to define their role in the game. So far, play tests are being carried out involving

university middle to high school and university students to refine the game prototype before publication.

Playstocene represents a case study of science communication and gamification that will allow us to collect data about public engagement and innovative teaching techniques as well as to conduct an experience of collaboration between art, science, and education.

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[Talk] [student]

Dental Microwear Texture Analysis (DMTA) in Late Pleistocene rodents from Mani Peninsula, Greece: a methodological approach

Iliana Alexiou[1,2,*], Marianthi Tzortzi[1], George Iliopoulos[1], Alexander Daasch[3], Thomas M. Kaiser[3] & Andreas Darlas[4]

[1] Department of Geology, University of Patras, Rio Patras, Greece;

[2] School of Geology, Aristotle University of Thessaloniki, Thessaloniki, Greece;

[3] Museum of Nature Hamburg, Leibniz Institute for the Analysis of Biodiversity Change, Hamburg, Germany;

[4] Ephorate of Palaeoanthropology-Speleology, Hellenic Ministry of Culture, Athens, Greece;

[*] ilianalexiou@gmail.com – presenting author

Keywords: Dental microwear, Rodentia, Cricetidae, Muridae, Quaternary.

This study presents a methodological approach for applying Dental Microwear Texture Analysis (DMTA) to rodent molars, with a focus on identifying reliable scan areas and addressing challenges in surface acquisition. The material consists of 192 rodent molar specimens from two Late Pleistocene cave sites in Mani Peninsula, southern Peloponnese, Greece. A total of 192 rodent teeth were examined, 103 from Kalamakia Cave and 89 from Melitzia Cave. 51 specimens were attributed to the genus *Apodemus* and 141 to the genus *Microtus*. All specimens were measured using the confocal microscope NanoFocus μsurf custom (NanoFocus AG). The upper first molars (M1) of *Apodemus* were selected for the analysis, while for *Microtus*, the lower first molars (m1) respectively. Only teeth with well-preserved and clearly defined wear facets were included in the analysis.

DMTA was conducted using MountainsMap Premium v.10.3 (DigitalSurf), to assess the three-dimensional surface textures of occlusal wear facets. This high-resolution, quantitative method provides objective metrics related to the physical properties of food items, allowing dietary inferences to be drawn from microwear patterns. While DMTA offers powerful quantitative

insights into dietary behaviour, its application to rodent teeth poses significant technical challenges due to steep occlusal angles, enamel thinness, and facet variability.

In *Microtus*, the most consistent and reliable measurements were obtained from the anterior regions of the Buccal and Lingual Reentrant Angles (BRA, LRA), as well as the central occlusal surface (between triangles T1 and T5). In *Apodemus*, although the propalinal (antero-posterior) chewing motion theoretically involves all occlusal facets, in practice, scanning was limited by the curvature and steep inclination of the wear surfaces, particularly in the central and premolar regions. The most reliable measurements were obtained from the lingual side, after repositioning the tooth to align the chewing surface horizontally. Some usable data were also acquired from the buccal side, but only with repeated repositioning due to varying inclinations between facets.

These findings underscore the importance of adapting DMTA protocols to the specific dental morphology and wear orientation of small mammals. This study proposes a facet-specific scanning strategy to improve the reliability, reproducibility, and interpretive power of DMTA in rodent dietary reconstructions.

[Poster] [non-student]

Diversity and adaptation in avian wing bone inner structure: insights from extant and extinct Strisores (Aves)

Fabio Alfieri[1,2,*], Anne-Claire Fabre[1,3,4] & Daniel J. Field[2,4,5]

[1] Institute of Ecology and Evolution, Universität Bern, Bern, Switzerland;
[2] Department of Earth Sciences, University of Cambridge, Cambridge, United Kingdom;
[3] Naturhistorisches Museum der Burgergemeinde, Bern, Switzerland;
[4] Department of Life Sciences, The Natural History Museum, London, United Kingdom;
[5] Museum of Zoology, University of Cambridge, Cambridge, United Kingdom;
[*] fabio_alfieri@yahoo.it – presenting author.

Keywords: Strisores, *Archaeotrogon*, *Aegialornis*, wing, inner structure.

Avian diversity has largely resulted from peculiar anatomical acquisitions, especially the modification of forelimbs into wings. Wing bone morphology can offer insights into how bird anatomy has been shaped by phylogenetic or ecological demands, e.g. deriving from different flight behaviours. While wing bone macroevolution arose as not strongly driven by ecology, studying restricted taxonomic contexts may uncover subtler ecological signals. The Strisores clade - comprising nightjars, nighthawks, potoos, and apodiforms (i.e., swifts and hummingbirds) - exhibits a wide range of flight behaviours, making it an ideal group for exploring potential ecological influences on wing bone anatomy. We focused on the internal bone architecture of the humerus and ulna in 11 extant Strisores species, covering major lineages such as hummingbirds, swifts, owlet-nightjars, frogmouths and oilbirds. We also included two French Eocene–Oligocene taxa: *Archaeotrogon*, considered a close relative of nightjars/nighthawks, and *Aegialornis*, thought to be basal to swifts, hummingbirds, and oilbirds. We quantified structural traits from both the bone shafts (diaphyses) and articular ends (epiphyses), then used phylomorphospaces to assess whether structural patterns relate to different flight styles and how extinct Strisores relate to extant taxa diversity. We found that hummingbirds are the only Strisores consistently displaying a distinctive wing bone structure. Their wing bone inner structure - characterized by denser and more complex trabecular bone

and more compact shafts—potentially reflects adaptations to the high biomechanical demands of hovering. Interestingly, the chimney swift showed notable structural similarity to hummingbirds. These patterns suggest that certain traits may be shared with hummingbirds either due to functional convergence or due to their plesiomorphic nature. *Archaeotrogon* partially resembled hummingbirds and swifts in different parts of the humerus. In contrast, *Aegialornis* retained a more conserved internal structure, aligning well with its phylogenetic position, i.e. diverging earlier than apodiforms' diversification. In summary, while inner wing bone structure does not broadly track the flight style diversity within Strisores, the unique structure of hummingbirds - and possibly the partial convergence of the chimney swift - suggests some potential functional adaptations to flight style within apodiforms. The partial resemblance of *Archaeotrogon* to hummingbirds or swifts opens to possible convergence and offers a window into the ecology of extinct Strisores.

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[Talk] [non-student]

Reappraisal of the lower Paleogene chondrichthyan assemblages from the Euganei Hills (northeastern Italy)

Jacopo Amalfitano[1,*], Eliana Fornaciari[1] & Luca Giusberti[1]

[1] Department of Geosciences, University of Padova, Padova, Italy;
[*] jacopo.amalfitano@unipd.it – presenting author

Keywords: Fossil sharks, Chondrichthyes, Europe, Paleogene, taxonomy.

The Euganei Hills (northeastern Italy) are extinct subvulcanic edifices mostly formed in the Oligocene by viscous magmatic activity which took place in the form of laccoliths intruded in the local sedimentary succession. These domes now rise from the surrounding alluvial plain deposits as isolated reliefs. The Euganean sedimentary succession is characterized by pelagic deposits, spanning from the Upper Jurassic to the Oligocene, mostly represented by calcareous and marly units. Several quarries operated in the area up to the early nineties, intercepting the Upper Cretaceous–middle Eocene interval. The quarrying activity allowed several palaeontological discoveries, primarily the upper Cenomanian OAE2 fish assemblage of Cinto Euganeo in the mid- 1970s. Moreover, the upper Cretaceous–lower Paleogene interval exploited in the southern Euganei Hills has yielded several remains of chondrichthyans, mainly isolated teeth, vertebrae, and associated tooth sets. The fossils were preliminary previously identified and briefly described in an informative book, but they were never investigated in detail. The aim of this study is redescribing thoroughly these fossil remains referring to the up-to-date systematic knowledge and clarifying their precise stratigraphic provenance using calcareous nannofossil analyses of embedding matrix. The assemblages comprise both pelagic and deep-water taxa such as *Otodus*, *Hexanchus*, *Notidanodon* and the poorly known chlamydoselachid *Proteothrinax*. This reappraisal will contribute to define properly the palaeodiversity of the chondrichthyan assemblages from this area and investigate their relationships with the climatic and evolutionary events characterizing the early Paleogene interval, such as the PETM and the EECO events.

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[Talk] [non-student]

Exploring interrelationships between fossil and extant lorisids (Primates, Strepsirrhini) and the question of their biogeographic origins

Holly E. Anderson[1,*], Adam Lis[2], Laura Mulvey[3] & Sergi López-Torres[1]

[1]University of Warsaw, Faculty of Biology, Warsaw, Poland;
[2]Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[3]Queen Mary University of London, School of Biological and Behavioural Sciences, London, E1 4NS, United Kingdom;
[*] h.anderson@uw.edu.pl – presenting author

Keywords: Lorisidae, phylogeny, Bayesian Total Evidence, Strepsirrhini.

Extant lorisids are distributed across equatorial Africa (pottos and angwantibos) and Southeast Asia (slow and slender lorises). This notable degree of geographic separation suggests a complicated evolutionary history. Molecular phylogenetic analyses have addressed the interrelationships among extant lorisids and generally agree with the family being divided into two monophyletic clades: the African Perodicticinae and Asian Lorisinae. However, how modern lorisids relate to their extinct kin is poorly understood. Here, we created a data matrix of 191 morphological characters for 17 extant lorisoids (14 lorisids and 3 galagids) and 13 fossil lorisoids to test their interrelationships, making it the most comprehensive phylogenetic study for this primate group. Molecular sequence data are also included for 14 of the extant taxa, and a Bayesian Total Evidence analysis was performed. *Karinisia*, a late Eocene stem lorisoid, was used as the outgroup.

A summary tree from the posterior distribution of trees is consistent with previous molecular phylogenies that separate monophyletic Perodicticinae and Lorisinae. The Pliocene *Laetolia* is resolved as sister to modern galagids, and the other stem Galagidae are composed of several species of Miocene *Komba*. This is consistent with previous hypotheses for interrelationships of fossil galagos.

Concerning lorisids, the Late Miocene *Nycticeboides* from Pakistan appears more closely related to modern *Loris* from Asia (high posterior support value of 0.8945). However, another

known lorisid from Pakistan falls within African Perodicticinae, suggesting complex migrations of this group between Africa and Asia. The hypothesis that all *Mioeuoticus* species form their own subfamily, Mioeuoticinae, at the stem of Lorisidae is not supported. One species, *Mioeuoticus kichotoi*, is well nested within Perodicticinae, and more closely related to the angwantibos (*Arctocebus*) (low posterior support value of 0.306). Another species, *Mioeuoticus shipmani*, falls at the stem of Lorisoidea, even more basal than previously hypothesised. The enigmatic Middle Miocene lorisid from Fort Ternan (Kenya) is not resolved as a lorisid and may belong to a more basal radiation of lorisoids (high posterior support value of 0.8756). Finally, the oldest alleged lorisid, *Namaloris* from the Oligocene of Namibia, appears as being the most basal galagid instead (low posterior support value of 0.2921), putting its ascription to Lorisidae in doubt.

The resulting tree is more consistent with an African origin of the family Lorisidae, as opposed to an Asian origin. This result would agree with previous inferences that lorisids may have used the "*Gomphotherium* Landbridge" to reach Asia from Africa during the Middle Miocene.

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[Poster] [student]

Preliminary skeletal analyses on the remains of *Lynx* (Carnivora, Felidae) from Quibas (Abanilla, Murcia, Spain)

Jury Antonelli[1,*], Samuele Frosali[1], Joan Madurell-Malapeira[1], Lorenzo Rook[1], Elena Moreno-Ribas[2,3], Casto Laborda-López[2], Claudia Iannicelli[2], Albert Navarro-Gil[2], Francisco Javier Salcedo[4], Jordi Agustí[2,5], Pedro Piñero[2,6], Alberto Martin-Serra[7] & Saverio Bartolini-Lucenti[1,5]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;
[2] IPHES-CERCA, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain;
[3] Àrea de Prehistòria, Universitat Rovira i Virgili (URV), Tarragona, Spain;
[4] Consejería de Sostenibilidad, Medio Ambiente y Economía Azul, Sevilla, Spain;
[5] ICP-CERCA, Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Edifici ICTA-ICP, Cerdanyola del Vallès, Barcelona, Spain;
[6] Departament de Botànica i Geologia, Universitat de València, Burjassot, Spain;
7 Departamento de Ecología y Geología, Universidad de Málaga, Málaga, Spain;
[*] jury.antonelli@edu.unifi.it – presenting author

Keywords: Iberian lynx, Calabrian, dietary specialitzation.

One of the most significant moments for the evolution of Quaternary ecosystems of Europe is the Epivillafranchian biochron, a period spanning roughly between 1.2 and 0.8 Ma and characterized by oscillating shifts in environmental conditions due to the progressive establishment of the '*Early-Middle Pleistocene Transition*'. The karstic site of Quibas in Southeastern Spain, referred to a time span 1.1–0.9 Ma (MIS33-27), records perfectly this timespan poorly known, especially from southern Iberian Peninsula. The recorded terrestrial vertebrates are diverse consisting of possibly up to eighty taxa. Among them the remains of some individuals of lynx, here referred to the Iberian lynx *Lynx pardinus*. Today, one of the

most endangered felid species, this species is characterized by a long and complex evolutionary history. Traditionally, the Iberian Peninsula has been considered its primary refuge since the Holocene, but its geographical origin is a matter of debate nowadays. We analyze here the unpublished skeletal remains of lynx from the recent years field surveys (2019–2024), all of them coming from levels correlated with the Jaramillo subchron (1.07–0.99 Ma), in comparison to extant lynx species and other felids. Considering the peculiar hunting strategy and high dietary specialization on rabbits of the Iberian lynx, our purpose is deciphering the exact chronological moment and the causes of this dietary specialization and even if it is present already in Calabrian specimens.

[Talk] [non-student]

New teleost fossils from the La Luna Formation in Venezuela shed new light on the marine Late Cretaceous biodiversity of fishes of the proto-Caribbean

Thodoris Argyriou[1,*], Jorge D. Carrillo-Briceño[2] & Marcelo R. Sánchez-Villagra[2]

[1]Department of Science and Mathematics, Deree - The American College of Greece, Athens, Greece;
[2]Department of Paleontology, University of Zurich, Zurich, Switzerland;
[*] targyriou@acg.edu – presenting author

Keywords: Late Cretaceous, Venezuela, La Luna Formation, Proto-Caribbean, Teleostei.

The early Late Cretaceous world was marked by a global climatic optimum, which culminated in a severe oceanic anoxia-driven biodiversity crisis at the Cenomanian–Turonian Boundary (~93.9 Ma). This time interval coincides with elevated diversification rates across many lineages of marine teleost actinopterygians, some of which form the backbone of the extant evolutionary fauna. Most of the documentation for this diversification interval comes from well-studied exposures in the Global North and the Peritethyan Realm, while studies of findings from coeval sites in regions like South America are sparse at best. The intermittently studied marine Late Cretaceous rocks of the La Luna Formation, in Venezuela and Colombia, yield promising fossils that can bridge this gap of knowledge. Previous studies of actinopterygians from the La Luna Formation. either concluded at a preliminary level and/or addressed a limited taxonomic sample. In this work, we investigated a larger and diverse fossil fish sample hosted in Venezuelan museum collections, deriving from pelagic limestones of the lower (Cenomanian–Turonian) part of the La Luna Formation in the Trujillo and Julia States of the country. Our material includes both isolated and articulated specimens that correspond to a moderately biodiverse collection of pelagic teleost genera. The occurrence of †*Pachyrhizodus* (†Pachyrhizodontidae) and two morphotypes of †*Enchodus* (†Enchodontidae), confirm some previously hinted occurrences at the genus level. One †*Enchodus* morphotype shows similarities with North American taxa, but might represent a new species, due to its slender

nature, the number of symphyseal prongs and the lack of marginal dentition. We also report the presence of a potentially new species of †*Gillicus* (†Saurodontidae). These fossils represent the oldest known occurrences of these genera on the South American continent. Together with previously reported †*Belonostomus*, †*Xiphactinus*, and †*Bananogmius*, the findings presented herein add new taxa to the scantly known Late Cretaceous teleost palaeodiversity of the southern margin of the Proto-Caribbean, highlighting both the importance and the potential of the fossiliferous rocks of the lower part of the La Luna Formation for assessing the taxonomic and spatiotemporal diversification of marine teleosts at the onset of the Late Cretaceous. They are also crucial for reconstructing the biogeographic pathways that connected the celebrated Late Cretaceous ichthyofaunas of the Western Interior Seaway in North America with coeval ones from the Peritethyan Realm and the English Chalk.

[Talk] [student]

‘Super-size’ portions only please? Exploring the origins of wide-gaped feeding in Paleogene snake taxa across the Americas

Roxanne E. Armfield[1,*], Jacques A. Gauthier[1,2] & Derek E.G. Briggs[1,2]

[1] Department of Earth and Planetary Sciences, Yale University, New Haven, Connecticut, USA;
[2] Yale Peabody Museum, New Haven, Connecticut, USA;
[*] roxanne.armfield@yale.edu – presenting author

Keywords: Snakes, macrostomy, morphology, Paleocene, macroevolution.

Snakes are some of the most successful hypercarnivorous vertebrates of the modern world. Slithering in at over 4,100 described species to date, modern snakes have a nearly cosmopolitan distribution, being found on all continents excluding the polar regions, and inhabit a variety of ecological niches. The evolution of 'wide-gaped feeding' (macrostomy) is often cited as the driver to the rapid speciation and subsequent global success of modern alethinophidian snakes. However, we consider macrostomy a complex multistate trait designation, and accurate attribution requires combining evidence from morphological, functional, behavioural, and ecological perspectives. Our understanding of the timing, acquisition and origins of these numerous traits is hindered by a poor fossil record lacking diagnostic cranial material, and by conflicting phylogenetic topologies which present contrasting evolutionary scenarios for character acquisition. Our recent analyses include the examination of new fossil specimens preserving cranial material, in addition to describing two new species of fossil alethinophidian from the Paleocene and Eocene of North America. Our phylogenetic analyses suggest stem-Pythonoidea were present in the North American west during the early Paleocene. Our new data contest the model of an entirely linear, stepwise gain of wide-gaped feeding traits suggested by morphological phylogenetics, and instead present a more complex scenario of losses and gains of palatomaxillary mobility across the early history of Alethinophidia.

[Poster] [non-student]

Not only boring issues: bioerosion on bones and their implications for carcass decomposition on Haţeg Island

Felix J. Augustin[1,*], Anne Bettermann[1] & Zoltan Csiki-Sava[2,3]

[1] Department of Geosciences, University of Tübingen, Tübingen, Germany;
[2] Department of Geology, Mineralogy and Palaeontology, Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania;
[3] ELTE Eötvös Loránd University, Institute of Geography and Earth Sciences, Department of Palaeontology, Budapest, Hungary;
[*] felix.augustin@uni-tuebingen.de – presenting author

Keywords: Bioerosion, Haţeg Island, Late Cretaceous, taphonomy, palaeoecology.

Bioerosional trace fossils on bones can yield numerous insights into the palaeoecology and taphonomy of fossil vertebrate assemblages. Despite this potential for revealing details of the dynamics of past ecosystems, such traces have rarely been systematically studied. Moreover, if present, bioerosional trace fossils are often reported from only a few isolated bones, while exhaustive documentation of entire collections is rarely done. The uppermost Cretaceous continental deposits from the Haţeg Basin (western Romania) – famous for their rich and diverse, island-dwelling vertebrate faunas – has previously yielded several examples of bioerosion on bones. However, only few of them have been described in detail thus far, and by far the largest part of these reports stems from a single lithostratigraphic unit (Sînpetru Formation), and two neighbouring localities ('La Cărare' and 'La Scoabă' near Sânpetru in the central part of the basin). A recently conducted, extensive survey in the palaeontological collection of the University of Bucharest, which houses the largest number of vertebrate fossils from the Haţeg Basin, has numerous new examples of bioerosion on bone. More specifically, such traces have now been recognised on bones from three additional localities representing three further distinct lithostratigraphic units – Tuştea (Densuş-Ciula Formation), Nălaţ-Vad ('Râul Mare Beds'), and Pui ('Pui Beds'). Morphologically, the bioerosional trace fossils comprise paired grooves, star-shaped pits, extensively damaged areas (all affecting only the

cortical bone), as well as sediment-filled boreholes (penetrating the cortical and cancellous bone). The traces resemble previously described ones from the Sînpetru Formation and are tentatively ascribed to multituberculate mammals (paired grooves), dermestid beetles (boreholes), and termites (star-shaped pits and possibly the extensively damaged areas). Bioerosion is found primarily on turtle and dinosaur bones (besides unidentified bone fragments). The newly identified traces demonstrate that bioerosion on bones is more widely distributed in the uppermost Cretaceous of the Haţeg Basin than previously recognised – both spatially and temporally, ranging now from the lower to the upper Maastrichtian, and from the southeastern to the northwestern part of the basin. Furthermore, bioerosional trace fossils are apparently present on bones recovered from various depositional and environmental settings, including braided river systems with poorly- to moderately well-drained (Sânpetru) and well-drained floodplains (Tuştea), as well as meandering river systems with well-drained (Pui) and poorly-drained floodplains (Nălaţ-Vad). Generally, the mode of carcass decomposition was relatively similar throughout the sampled localities of the 'Haţeg Island' (unaffected by geological age or environmental setting), and involved a consistent set of saprophagous animals.

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[Poster] [non-student]

Reinterpretation of *Plioviverrops faventinus* (Carnivora, Hyaenidae) reloaded: the last survivor of a successful genus

Saverio Bartolini-Lucenti[1,2,*], Cecilia Loddi[1] & Joan Madurell-Malapeira[1]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab , Università degli Studi di Firenze, Florence, Italy;

[2] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Edifici ICTA-ICP, Cerdanyola del Vallès, Barcelona, Spain;

[*] saverio.bartolinilucenti@unifi.it – presenting author

Keywords: Systematics, palaeoecology, ecomorphology, early hyaenids, Miocene.

The taxonomic and systematic complexities associated with the Middle–Late Miocene small-sized hyaenids encompass several taxa typically attributed to the genera *Protictitherium* and *Plioviverrops*. Notably, the latter has often been linked to the extant aardwolf, *Proteles cristatus*; however, recent research placed it in its own genus, *Gansuyaena*, as a plausible ancestral lineage to the African *Proteles*. Generally speaking, there is a paucity of specific studies on these small hyaenids, resulting in limited knowledge regarding their systematics and phylogenetic relationships. Instead, they have been ecomorphologically categorized as civet-like and mongoose-like hyaenids based on morphological and metric characteristics. Frequently overlooked in scholarly literature, *Plioviverrops faventinus* was initially described by Danilo Torre, who first acknowledged the distinctiveness of the latest species established within the genus *Plioviverrops*. In this work, we perform a revision of the sample from the type locality of Cava Monticino (Brisighella, Ravenna, Italy), elucidating the affinities and distinctions among other species of *Plioviverrops*, as well as those of *Protictitherium* and *Gansuyaena*. Furthermore, we examine dentognathic characteristics to assess the ecological preferences of *Plioviverrops faventinus* and other small-sized hyaenids, in comparison to a sample of extant Herpestidae and Viverridae. Our ecological findings suggest a pronounced hypocarnivorous / invertebrivorous specialization in *Plioviverrops faventinus*, analogous to certain extant herpestids.

[Talk] [non-student]

Early dispersal and niche partitioning in *Canis* (Carnivora, Canidae) from the Early Pleistocene of Fonelas P-1 (Guadix-Baza basin, Granada, Spain)

Saverio Bartolini-Lucenti[1,2,*], Joan Madurell-Malapeira[1], Guiomar Garrido[3], Lorenzo Rook[1] & Alfonso Arribas[4]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;

[2] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Barcelona, Spain;

[3] Universidad Internacional de La Rioja, La Rioja, Spain;

[4] Estación Paleontológica Valle del río Fardes (Museo Geominero), CN Instituto Geológico y Minero de España-CSIC, Madrid, Spain;

[*] saverio.bartolinilucenti@unifi.it – presenting author

Keywords: Fonelas P-1, *Canis arnensis*, *Canis etruscus*, niche partitioning, palaeoecology.

The Fonelas P-1 site in southern Spain (approximately 2.0 Ma) has furnished an exceptional perspective on canid diversity and ecology during the Early Pleistocene in Europe. This research documents two medium-sized canid morphotypes identified at the site, corresponding to the species *Canis arnensis* Del Campana, 1913 and *Canis etruscus* Forsyth Major, 1877. Morphological and ecomorphological analyses, incorporating cranial, dental, and mandibular characteristics, validate their taxonomic identities and ecological differentiation. The presence of *Canis arnensis* at Fonelas P-1 extends the known geographic and temporal distribution of this species, supplying substantial evidence of its occurrence in southern Europe prior to 2 Ma. The simultaneous occurrence of *Canis arnensis* and *C. etruscus* at this well-dated site reopens the question of the ecological role that these two canids occupied in the same environment. The morphometric analysis of key dentognathic ratios allowed us to identify for the first time the ecological divergence between them. Our result suggests that *Canis arnensis* possessed a mesocarnivorous dietary niche comparable to extant jackal/coyote-like canids, whereas *Canis etruscus* demonstrates adaptations indicative of a shift towards hypercarnivory similar to the extant gray wolf (*Canis lupus*). These results elucidate the complexity of Early Pleistocene canid guilds, providing vital insights into their dispersal patterns, adaptive strategies, and interactions within the taphocenoses.

[Talk] [student]

A new pterosaur bonebed from the Late Jurassic of Argentina

Victor Beccari[1,2,*], Alexandra E. Fernandes[3], José L. Carballido[4], Diego Pol[4,5] & Oliver W. M. Rauhut[1,2,6]

[1] SNSB-Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany;
[2] Department of Earth and Environmental Sciences, Ludwig-Maximilians-Universität, Munich, Germany;
[3] American Museum of Natural History, New York, NY, USA;
[4] Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina;
[5] Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Buenos Aires, Argentina;
[6] GeoBioCenter, Ludwig-Maximilians-Universität, Munich, Germany;
[*] victor.beccari@gmail.com – presenting author

Keywords: Pterosauria, Late Jurassic, South America, Argentina, Cañadón Calcáreo Formation.

The Late Jurassic record of pterosaurs from Gondwana is scarce, especially in South America, with some known material described from Chile, Uruguay, and Argentina. Regarding Argentina, although several, mainly fragmentary pterosaur remains are known, ranging from the Early Jurassic and up to the Late Cretaceous, only two named taxa have been described so far for the Late Jurassic (i.e., *Herbstosaurus pigmaeus* and *Wenupteryx uzi*). Both taxa are known by incomplete, mainly postcranial material from the Tithonian Vaca Muerta Formation. Here, we report a new fossil site from the Late Jurassic (Oxfordian–Kimmeridgian) deposits of the Cañadón Calcáreo Formation, Chubut Province, which contains multiple isolated, but tightly packed and 3-dimensionally preserved, bones. During the excavation, a quarry of 5 square meters was opened, which has so far yielded cranial material (represented mainly by jaw fragments), as well as some vertebrae and appendicular bones (such as a humerus, ulna, multiple metacarpals, and wing phalanges, and more under preparation). All recovered jaws from this locality (n = 15) seem to originate from a single taxon, with a large amplitude of sizes

between individuals, indicating that an ontogenetic series is present. These jaws are elongated, with multiple alveoli positioned laterally. The teeth are circular in cross section, but most are broken, so that their complete length cannot be estimated. Our preliminary phylogenetic analysis places the new specimens within Ctenochasmatidae. This Argentinean pterosaur differs from other known South American ctenochasmatids in not having a lateral expansion of the anterior tip of the jaws, which is present in *Tacuadactylus luciae* (Late Jurassic [Tithonian] of Uruguay), and by having discrete, robust teeth, differing from *Pterodaustro guinazui* (Early Cretaceous [Albian] of Argentina). This find thus represents the earliest ctenochasmatid from Argentina, and South America as a whole, so far, likely pertaining to a yet undescribed new species. The occurrence of ctenochasmatids in the early Late Jurassic of Patagonia underlines the wide distribution of this clade already at that time, indicating an earlier, probably Middle Jurassic origin of the group. Furthermore, a sizeable lower jaw (around 200 mm) and cervical vertebrae from the new locality indicates that these animals reached large sizes at that time.

[Poster] [student]

Postcranial skeletal pneumaticity in Late Triassic sauropodomorph dinosaurs

Samantha L. Beeston[1*], Daniela Schwarz[2], Paul Upchurch[1], Paul M. Barrett[3] & Philip D. Mannion[1]

[1] Department of Earth Sciences, University College London, London, United Kingdom;

[2] Museum für Naturkunde, Leibniz Institute for Research on Evolution and Biodiversity, Berlin, Germany;

[3] Fossil Reptiles, Amphibians, and Birds Section, Natural History Museum, London, United Kingdom;

[*] samanthalbeeston@gmail.com – presenting author

Keywords: Dinosauria, postcranial skeletal pneumaticity, Sauropodomorpha, Triassic.

Within Archosauria, postcranial skeletal pneumaticity (PSP) occurs in pterosaurs, theropods (including birds), and sauropods. However, the evolutionary origins of PSP in the latter group remain unknown. To better understand the evolution of PSP in non-sauropod sauropodomorphs, we CT-scanned representative elements from the presacral vertebral columns of the early-branching sauropodomorphs *Pantydraco caducus*, *Thecodontosaurus antiquus*, *Ruehleia bedheimensis*, and *Plateosaurus* sp., all from the Upper Triassic of Europe. These were compared with all other early sauropodomorphs that have had presacral vertebrae CT-scanned, namely *Buriolestes schultzi*, *Pampadromaeus barberenai*, and *Macrocollum itaquii*, all from the Upper Triassic of Brazil. PSP is absent in the middle–posterior cervical vertebrae and middle dorsal vertebrae of *Buriolestes*, the middle dorsal vertebra of *Pampadromaeus*, the anterior–middle cervical vertebrae of *Pantydraco*, and the anterior cervical vertebra and middle–posterior dorsal vertebrae of *Thecodontosaurus*. It is possible that the neural arches of the posterior cervical vertebrae of *Thecodontosaurus* possess PSP, but this has been interpreted from broken transverse cross-sections and not CT scans. The posterior cervical vertebrae of *Ruehleia* possess PSP in the neural arches, whereas the centra of the posterior cervical vertebrae and the centra and neural arches of the anterior–middle dorsal vertebrae are apneumatic. Where

present, pneumatic internal cavities are neither exclusively camerate nor camellate, and they do not align with the 'protocamerate' tissue type previously described in the centrum and neural arch of the posterior cervical vertebra and the neural arch of the anterior dorsal vertebra of *Macrocollum*. Of the examined taxa, *Plateosaurus* possesses the highest prevalence of PSP, with pneumatic internal cavities present in the neural arches of the middle cervical vertebrae–middle dorsal vertebrae. However, the centra of the presacral vertebrae of *Plateosaurus* are apneumatic. Occurrences of PSP in Late Triassic early sauropodomorphs do not appear to be correlated with an increase in body size: *Ruehleia* is larger than *Plateosaurus* (8 metres and 6.5 metres long, respectively) despite a lower occurrence of PSP in the former, and PSP occurs across more of the vertebral column of *Macrocollum* than *Ruehleia*, despite *Macrocollum* being only 2.3 metres long. Furthermore, *Thecodontosaurus* potentially possesses similar levels of PSP as *Ruehleia*, despite being three times smaller. Instead, our preliminary results suggest that PSP shows a broad phylogenetic signal, with increased development of PSP in more 'derived' sauropodomorphs, although there does appear to be some variation along lineages.

[Talk] [non-student]

First in situ dinosaur tracks from the Aofous Formation (Lower Cretaceous, Kem Kem area, Morocco)

Matteo Belvedere[1,*], Jacopo Nesi[1], Anna Andreetta[2], Anna Breda[3], Marco Bonini[4], Montanari Domenico[4], Mauro Papini[1], Guido Roghi[5], Federico Sani[1], Camilla Vidi[3] & Marco Benvenuti[1]

[1] Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Florence, Italy;

[2] Dipartimento di Scienze Chimiche e Geologiche, Università degli Studi di Cagliari, Cagliari, Italy;

[3] Dipartimento di Geoscienze, Università degli Studi di Padova, Padova, Italy;

[4] Institute of Geosciences and Earth Resources, National Research Council of Italy (CNR), Florence, Italy;

[5] Institute of Geosciences and Earth Resources, National Research Council of Italy (CNR), Padova, Italy;

[*] matteo.belvedere@unifi.it – presenting author

Keywords: Dinosaur tracks, swim tracks, Kem Kem beds, Lower Cretaceous, Morocco.

Southern Morocco offers continuous and well-exposed outcrops of "mid" Cretaceous sediments that, in this area, are known as Kem-Kem beds. They were first described in the early 20th century as the 'continental intercalaire' and correlated to many other north African successions from Egypt (Bahariya Formation) to the Hoggar Mountains in Niger. These deposits, generally unconformably lying on Palaeozoic rocks, are capped by shallow-marine carbonate sediments and have been providing an incredibly rich vertebrate and invertebrate fossil assemblage. The succession records an overall transgressive cycle that starts with the Ifezouane Formation, an Albian?–early Cenomanian cross-bedded sandy unit that testifies a fluvial to deltaic system prograding towards the Tethys. The overlying Aofous Formation witnesses the evolution of the depositional environment to a mud-flat coastal area with lower sediment supply and sabkha-like conditions. On top of this succession rests a Cenomanian–Turonian carbonate platform, the Akrabou Formation, that attests a general marine ingression corresponding to the highest sea-

level of the Phanerozoic and one of the most important Oceanic Anoxic Event in the geological record (OAE2).

Dinosaur tracks are known in literature from the uppermost part of the Aofous Formation from many localities, mostly in the southern part of the Kem Kem beds. All the tracks have been found so far preserved as convex hyporeliefs on isolated blocks. Here we present the first in situ vertebrate footprints in the region. Two sites were found at the base of the Ifezoune Formation, with poorly preserved swimming tracks of small turtles or crocodiles, and small tridactyl dinosaur tracks (possibly theropods). Another site has been found towards the top of the Aofous Formation, in a position stratigraphically similar to that of the tracks already known from the southern part of the region. Here sauropod, and large and small theropod tracks were identified. Although the poor preservation does not allow further ichnotaxonomical identification, they represent the first unequivocal in situ dinosaur tracks in the region and the northernmost record so far for that stratigraphical interval. Such discoveries, integrated with regional sedimentological and stratigraphical studies, will produce an updated palaeogeography of the area.

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[Talk] [non-student]

Citius, Altius, Longius. Longest and highest-pace rhinocerotid trackway from the early Oligocene of France sheds light on the need to revise pace-based size estimates

Matteo Belvedere[1,*], Luca Pandolfi[2], Pauline Coster[3] & Loïc Costeur[4]

[1] Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Florence, Italy;

[2] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;

[3] Réserve Naturelle Nationale Géologique du Luberon, Parc naturel régional du Luberon, Luberon UNESCO Global Geopark, Apt, France;

[4] Naturhistorisches Museum Basel, Basel, Switzerland;

[*] matteo.belvedere@unifi.it – presenting author

Keywords: Rhinocerotidae tracks, Perissodactyla, size estimate, locomotion, lower Oligocene.

Mammal tracks of the Parc naturel régional du Luberon area are known since the 1980s, with 11 tracksites documented so far; their age ranges from early to late Oligocene and are impressed in lacustrine carbonate or marls during emersion phases.

Here we focus on the "Carrière de Triclavel" tracksite (Viens, southeastern France), specifically on a trackway found onto the lower level of the Rupelian Calcaire de la Fayette Formation. Discovered in 2010 and re-examined in 2022, the trackway is composed of 22 tracks arranged in 3 non continuous parts (of 9, 8 and 2 tracks) separated by isolated tracks. The tracks preserved are all pes impressions, with the manus either not impressed or, more likely, overstepped by the pes. Tracks have high fidelity, with all hoof marks preserved and often a clear metapodial impression. The tracks are classified as *Rhinoceripeda voconcense*, as those of the Saignon and Gignac ichnosites, with a possible trackmaker identified as *Ronzotherium*.

In addition to its exceptional length - placing it among the longest rhinocerotid trackways in the fossil record - this trackway is particularly notable for its unusually long pace (830 mm) and stride (1510 mm) lengths, especially when compared to the relatively small size of the pes tracks (PL: 129 mm; PW: 130 mm).When compared with the *Rhinoceripeda voconcense* holotype trackway (P12) from Saignon, the Viens tracks are 25% smaller despite having a similar pes

length. When compared with other smaller trackway (P8), it is only 13% smaller, yet it has a pace length 28% longer. This can be due to a higher velocity, resulting in longer pace and stride lengths. Given the hip height estimate of 720 mm this would imply a “flight” time, which could be compatible with a small animal, similar in size to *Epiaceratherium*.

Alternatively, it may be that the formula used since the 1980s to estimate the trackmaker size, based on pace length, needs a revision, at least for rhinocerotids. A different approach, based on the size of the track rather than on the pace measurements could provide more accurate data; we are testing which track parameter, i.e., pes length or width, will prove more consistent and reliable for size estimates. Measurements are currently being carried out on modern and extinct rhinocerotids, to test if a single ratio can be applied or if a correction factor linked to sediment rheology and the age of the specimen should be introduced.

[Poster] [student]

Analysis of the mechanical resistance of the armour of *Stagonolepis olenkae* Sulej, 2010 (Aetosauria, Stagonolepididae) from the Late Triassic of Poland, using 3D modelling and computer simulation

Przemysław Błaszczeć[1,*]

[1] Institute of Geology, Adam Mickiewicz University, Poland;

[*] przbla1@amu.edu.pl – presenting author

Keywords: Aetosauria, osteoderms, 3D modelling, photogrammetry, micro-computed tomography.

Aetosaurs (Archosauria, Pseudosuchia) were a group of armoured quadrupedal medium- to large-sized archosaurs. During the Late Triassic (Carnian to Rhaetian), they lived almost throughout the Pangaea, with fossils found in North and South America, Africa, Europe, and India. An extensive bony armour was a distinctive feature of aetosaurs, whose back and abdomen from the back of the head to the tip of the tail were covered by columns of often interlocking osteoderms. Occasionally, appendicular osteoderms also covered the limbs. It has been theorized that the dermal armour of aetosaurs provided a protection against predators, but this commonly held assumption has not yet been confirmed by more thorough analyses.

The armour of *Stagonolepis olenkae* Sulej, 2010, from the Late Triassic of Poland, has a diploe structure composed of layers of external and basal cortex surrounding an internal cancellous core. In the basal layer of the osteoderms, bundles of Sharpey's fibres and skeletochronological structures are present. The internal structures of the osteoderms indicate extensive remodelling processes, and the weak vascularization and bone tissues that constitute the plates – lamellar bone and parallel-fibred bone – suggest considerable mechanical resistance. Elements of the armour's osteology adapted to distribute and reduce mechanical stress might provide confirmation of the protective function of the armour as well. The aim of this research is to create an accurate 3D model of the dermal armour of *Stagonolepis olenkae* and to test its mechanical resistance during a hypothetical predator attack using Finite Element Analysis. Data

acquisition will utilize photogrammetry and micro-computed tomography scanning. Similar studies on the osteoderms of other extinct tetrapods have been conducted multiple times, primarily focusing on other archosaurs (including titanosaurian sauropods) and large cingulates. The influence of osteoderm osteological features on overall mechanical resistance has also been analysed. Nonetheless, most studies examined only single elements of dermal armour. Accordingly, such an analysis of aetosaur osteoderms represents the first of its kind in this interesting and peculiar archosaur group.

[Poster] [non-student]

Oligocene birds of Poland in a nutshell

Zbigniew M. Bochenski[1,*], **Krzysztof Wertz**[1,*] & Piotr Gryz[2]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[*] bochenski@isez.pan.krakow.pl / wertz@isez.pan.krakow.pl – presenting authors

Keywords: Fossil avifauna, new species, menilite shales, Paleogene, Paratethys.

The entire southeastern Poland is a huge palaeontological site covering about 15,000 square kilometers. It is currently a hilly woodland but numerous marine fish remains that are found almost everywhere attest that the area used to be part of the Paratethys Sea during the Oligocene. Bottom sediments were poorly oxygenated, which is why many organisms are preserved as fossils. The ichthyofauna is very characteristic for particular strata and can be used to establish the geological age. The Oligocene menilite shales of the Polish Carpathian Flysh deposits have also yielded some bird remains: in the last two decades, 15 bird specimens have been described. Some of them were found by enthusiasts amateur palaeontologists – Andrzej Górski, Albin Jamróz, Edward Noniewicz, Grzegorz Salwa, Damian Smoleń and Robert Szybiak – who made them available for scientific study, which was honored by naming new species after them or their family members. The specimens mostly represent small or very small birds not associated with water environment. They include eight new species, two species previously described from other regions of Europe, and five other specimens identified less precisely, with passerines being the most numerous. They belong to Procellariiformes (*Rupelornis definitus* [formerly known as *Diomedeoides lipsiensis*]), Galliformes (*Sobniogallus albinojamrozi*), Apodiformes (*Eurotrochilus noniewiczi*), Ralloidea (genus and species indet.), Upupiformes (*Laurillardia smoleni* and *Laurillardia munieri*), Accipitriformes (*Aviraptor longicrus*), Passeriformes (six

specimens: *Jamna szybiaki*, *Crosnoornis nargizia*, *Resoviaornis jamrozi*, *Winnicavis gorskii* and two indet.) and Aves indet. (two specimens). Although so few in number, the significance of Oligocene birds from Poland should not be underestimated. They often represent the oldest representatives in their taxonomic groups, providing valuable information about the early evolution of their orders. Some of them, such as the hummingbird (*Eurotrochilus noniewiczi*) or some of the Suboscine passerines (such as *Crosnoornis nargizia*), have no counterparts in the current fauna of Europe. The poster will present an overview of the described bird remains from the Oligocene of Poland.

[Talk] [student]

Endocranial anatomy of "thoracosaurs" (Archosauria, Crocodylia) and implications for gavialoid crocodylian evolution

Sophie A. C. M. Boerman[1,2,*], Paul M. J. Burke[3], Gwendal Perrichon[4], Johan Vellekoop[1,2], Thierry Smith[2], Adam Cossette[5], Jason Bourke[5], Philip D. Mannion[3] & Jeremy E. Martin[4]

[1] Department of Earth and Environmental Sciences, KU Leuven, Leuven, Belgium;

[2] Directorate Earth and History of Life, Royal Belgian Institute of Natural Sciences, Brussels, Belgium;

[3] Department of Earth Sciences, University College London, London, United Kingdom;

[4] Université Claude Bernard Lyon 1, ENSL, CNRS, LGL-TPE, Villeurbanne, France;

[5] New York Institute of Technology, Old Westbury, New York, USA;

[*] sophie.boerman@kuleuven.be – presenting author

Keywords: Endocranial anatomy, thoracosaurs, Crocodylia, Gavialoidea.

"Thoracosaurs" are a group of Late Cretaceous–early Paleogene longirostrine eusuchians, and one of the most controversial groups of that clade. Whilst their phylogenetic position varies between studies, many morphology- and total-evidence-based analyses retrieve the "thoracosaurs" as members of Gavialoidea, sometimes within Gavialidae, i.e., close relatives of the extant gharial *Gavialis gangeticus*. This not only implies the existence of long ghost lineages (potentially up to 100 million years), but also contradicts molecular clock estimates of an Oligocene–Early Miocene origin of gavialids. Recent advances in the computed tomography (CT) scanning of the skulls of eusuchians have allowed comparison of endocranial characters among a wide range of taxa. This has been put forward as an independent way to address the "thoracosaur" problem. Here, we present the endocranial anatomy of three "thoracosaurs": *Eothoracosaurus mississippiensis* from the Maastrichtian Ripley Formation, Mississippi, USA; *Thoracosaurus isorhynchus* from the Maastrichtian of Mont-Aimé, France; and *Thoracosaurus* sp. from the Danian of Limhamn, Sweden. We compare the endocast, paratympanic sinus system, and nasal cavity to extant and extinct eusuchians. Our observations suggest that

endocranial morphology is overall more reflective of lifestyle rather than phylogeny. Features such as the bulbous expansion of the olfactory region are also noted in unequivocally marine thalattosuchian crocodylomorphs, suggesting that our assemblage of "thoracosaurs", which all originate from shallow marine sediments, might have had a more marine ecology as well. However, a few characters are shared between "thoracosaurs" and *Gavialis,* such as the reduction of any quadrate cavities lateral to the pharyngotympanic sinus, the presence of pterygoid bullae, and an anteriorly expanded parietal process of the intertympanic sinus. The latter not found in any other gavialoid, which may either indicate reversal of this character state (taxic atavism) in *Gavialis*, or that 'thoracosaurs' are basal gavialoids, with *Gavialis* retaining characters that other fossil gavialoids lost.

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[Poster] [student]

Hidden treasures at the Liceo Dante (Florence): an innovative approach to connect students and Natural History heritage

Francesca Borchi[1,*] & Ilaria Pasini[2]

[1] Dipartimento di Scienze della Terra, Università di Firenze, Florence, Italy;

[2] I.I.S. Alberti Dante, Via F. Puccinotti 55, Florence, Italy;

[*] francesca.borchi@unifi.it – presenting author

Keywords: Museum collections, digitization, dissemination, heritage.

Founded in 1853 by the Grand Duke of Tuscany Leopoldo II, the Liceo Dante in Florence is the oldest public high school in Italy. At the time, the Natural History Museum of the University of Florence was known as "Gabinetto delle Scienze Naturali" and was not accessible to the public, which made the Liceo Dante the higher level of education available in the city. Professors at the Dante high school of the late 19th century borrowed specimens from the Gabinetto di Scienze Naturali to teach students botany, palaeontology, anatomy, geology and so on. For about a hundred years this tradition went on and further implemented the high school collections, that are now still displayed in the halls of the school but greatly overlooked and abandoned. To preserve this historical and vast collection, a handful of students volunteered to participate in a short course that aimed at the valorization of the specimens using different approaches. 11 fossil vertebrates from the Plio-Pleistocene of Tuscany were selected and cleaned. Students carried out scientific research for the identification of the specimen that often resulted in the updating of the original labels, and also searched for information about their entrance in the school collection. The educational project aims to raise awareness among students and the school community about the importance of the local fossil heritage through multidisciplinary activities. Divided into two phases, the project combines scientific, digital, artistic and communication skills. In the first phase, students acquired skills in cataloging, conservation and digitization of specimens through photogrammetry, creating a digital catalog and 3D models. In the second phase, they focused on the valorization through the creation of physical labels, an interactive web platform and QR codes to make the heritage accessible to a wide audience. The practical and collaborative approach guarantees complete educational experience, culminating in an interactive and innovative exhibition.

[Poster] [non-student]

Comparative skull osteology of *Elaphe* and related species (Serpentes, Colubridae)

Bartosz Borczyk[1,*] & Tomasz Skawiński[2]

[1] Department of Evolutionary Biology and Conservation of Vertebrates, University of Wrocław, Wrocław, Poland;

[2] Museum of Natural History, University of Wrocław, Wrocław, Poland;

[*] bartosz.borczyk@uwr.edu.pl – presenting author

Keywords: Squamata, morphology, phylogeny, systematics, taxonomy.

Correct identification of fossils depends heavily on the knowledge of osteological diversity of the extant members of the group. This is particularly true for relatively young clades, with an extensive fossil record. The colubrine snakes are a prominent example of such a clade. This group contains several hundred extant species and is well represented in the European Neogene and Quaternary. However, the osteological recognisability of many living species is poor at best. We analysed the skull osteology of 30 extant colubrines (species of *Gonyosoma*, *Coelognathus*, *Euprepiophis*, *Oreocryptophis*, *Orthriophis*, *Elaphe*, *Oocatochus*, *Coronella*, *Zamenis*, *Pantherophis*, *Lampropeltis*), usually based on multiple specimens. We have used the information obtained to assess taxonomic affiliation of several extinct European species (*Coronella miocaenica*, *Elaphe algorensis*, *Elaphe kohfidischi*, *Elaphe kormosi*, *Elaphe praelongissima*, *Elaphe szyndlari*). The recently proposed transfer of some of these species to *Zamenis* is not supported according to our novel osteological evidence. This may indicate that the material assigned to these species may represent more than one species – a possibility that could significantly complicate attempts to assess their phylogenetic position.

[Poster] [non-student]

The first record of *Gomphotherium inopinatum* (Proboscidea, Elephantimorpha) from Europe

Jakub Březina[1*], Csaba Tóth[2] & Daniel Madzia[3]

[1] Department of Geology and Paleontology, Moravian Museum, Brno, Czechia;
[2] Earth Science Institute of the Slovak Academy of Sciences, Bratislava, Slovakia;
[3] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[*] jbrezina@mzm.cz – presenting author

Keywords: Proboscidean phylogeny, *Gomphotherium*, Early Miocene, Czechia.

We assessed the mandible, upper tusk, and upper jaw fragment of a proboscidean found probably around 1905 in the Ottnangian ("middle" Burdigalian) sands exposed in a former sandpit near the Brno–Nový Lískovec urban district (South Moravia, Czechia). In 1906, Anton Rzehak identified the material as *Gomphotherium angustidens.* However, the elements were soon forgotten. Their rediscovery in the collections of the Moravian Museum revealed that the morphometric characters of the material do not fit the current diagnosis of *G. angustidens*. The original identification is not surprising, as the typically Middle Miocene *Gomphotherium angustidens* historically became a wastebasket taxon for a number of Early Miocene gomphotheres (e.g., *Gomphotherium subtapiroideum, Gomphotherium annectens, Gomphotherium pyrenaicus*).

The material consists of an incomplete mandible with an extremely worn m2 and a slightly worn m3. The mandibular symphysis is bent downward, and alveoli indicate the presence of tusks. The upper tusk is relatively short, robust, and with a distinct enamel band. It is slightly ventrolaterally curved, resulting in a subtle divergence of the upper tusks. The twisting of the tusk is indistinct. The maxilla contains worn M2 and a relatively short M3. Dental morphology can best be observed on the unworn M3/m3, which exhibit a combination of zygodont and bunodont patterns. This includes zygodont crests on the slightly compressed posttrite half-lophs and a combination of crescentoids and central conules on the pretrite half-ridges. The anterior

central conules are clearly visible only on M3, where they branch into two relatively broad bulges.

Phylogenetic analyses reveal the closest relationships with *Gomphotherium inopinatum* and *Gomphotherium subtapiroideum*. The studied M3 is trilophodont with a hint of a fourth loph, the m3 has a less-developed fourth lophid. These characters, along with the more pronounced anterior central conules, are characteristic of *Gomphotherium inopinatum*. The observed mesiolabially forced occlusion of the dental row appears to be more pronounced in *Gomphotherium inopinatum* than in *Gomphotherium subtapiroideum*. The first record of *Gomphotherium inopinatum* in Europe shows that members of the "*Gomphotherium annectens* group" were not the only representatives of European "early–middle" Burdigalian gomphotheres. The presumed close relationship between the highly bunodont *Gomphotherium angustidens* and the sub-bunodont *Gomphotherium inopinatum* (suggested by some authors) remains unclear, while a closer relationship between *Gomphotherium inopinatum* and *Gomphotherium subtapiroideum* appears more plausible. This highlights the crucial need for a modern revision of European Early Miocene elephantimorph material.

[Poster] [student]

Whose child is this? Juvenile features on an isolated crocodylomorph dentary from the Early Cretaceous of Galve, Spain

Alessia Buccella[1,*], Eduardo Puértolas-Pascual[2], Federico Fanti[1] & Miguel Moreno-Azanza[2]

[1]Dipartimento di Scienze Biologiche, Geologiche e Ambientali, Università di Bologna, Bologna, Italy;
[2]Aragosaurus-IUCA, Paleontología, Facultad de Ciencias, Universidad de Zaragoza, Zaragoza, Spain;
[*] alessiabuccella025@gmail.com – presenting author

Keywords: Barremian, Maestrazgo Basin, Crocodylomorpha.

Specimen EMPZ 2017/13, housed in Museo de Ciencias Naturales de la Universidad de Zaragoza, represents a mediolaterally slender, left dentary originating from the Barremian (Early Cretaceous) Cuesta Corrales 2 locality, in the El Castellar Formation, Galve, Spain. The specimen measures 5.2 cm in antero-posterior length, preserving the first seven tooth alveoli, with two teeth preserved in positions 3 and 4. A row of small nutrient foramina are visible in lateral view. The symphyseal area is crushed but extends posteriorly to the fourth alveoli. There is a wide Meckelian canal extending from the third tooth position to the preserved posterior end of the bone. Preserved teeth are folidont, labiolingually compressed and constricted at the base of the crown. They are unserrated, gently curved distally, with incipient medial and distal carinae. The third tooth is 1.5 times larger than the fourth and less symmetric. Tomographic and virtual observations revealed the neuro-vascular system and the overall morphology of the alveoli.

Crocodylomorph affinities of this specimen have been assessed based on the heterodont dentition and the anteriorly procumbent dentary with a dorsoventral expansion below the third and largest tooth socket. However, a precise taxonomic classification is hindered by the unusual combination of characters present in this fossil. Its most enigmatic features were found to be typical of juveniles, such as the short dentary with few teeth, a small symphysis and labiolingually compressed folidont dentition. This fossil's size is within range of other juvenile

specimens. Moreover, the lateral surface of the dentary is nearly smooth, lacking the typical pits and grooves ornamentation seen in mature crocodyliforms. Cladistic evaluations recover this fossil in a basal position in the Crocodylomorpha tree, as sister taxon to *Junggarsuchus sloani* from the Jurassic of China. However, anatomical comparisons against clades with similar spatio-temporal distributions suggest that it represents a previously unreported taxon.

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[Talk] [non-student]

Revision of trackmaker correlation for *Ichniotherium* tracks from the Thuringian Forest and implications for models of diadectid locomotion

Michael Buchwitz[1,*], Lorenzo Marchetti[2], Tom Hübner[3], Andreas Jannel[4] & Jörg Fröbisch[2,5]

[1]Museum für Naturkunde Magdeburg, Magdeburg, Germany;
[2]Museum für Naturkunde Berlin, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[3]Friedenstein Stiftung Gotha, Schloss Friedenstein, Gotha, Germany;
[4]Liverpool John Moores University, Liverpool, United Kingdom;
[5]Humboldt-Universität zu Berlin, Institut für Biologie, Berlin, Germany;
* mbuchwitz@web.de – presenting author

Keywords: Ichnology, trackway, Bromacker, Diadectomorpha, Rotliegend.

Since the 2000s, the available sample size of *Ichniotherium* trackways from the early Permian Tambach Formation (Bromacker locality, central Germany) increased. This enabled the ichnotaxonomic distinction between *Ichniotherium sphaerodactylum* and *Ichniotherium cottae* and their attribution to the Bromacker diadectids *Orobates pabsti* and *Diadectes absitus*, respectively. New excavations that were part of the Bromacker research and science communication project (2020–2025) yielded body and trace fossil finds that shed new light on diadectid track-trackmaker correlation. A partially articulated skeleton assigned to *D. absitus* includes a pes – which was absent in the type material – and, in contrast to the expected similarity to North American *Diadectes* spp. and the track type *Ichniotherium cottae*, the foot proportions of *Diadectes absitus* are in better agreement with co-occurring *Ichniotherium sphaerodactylum* tracks. Furthermore, despite the differences in bone proportions, the ratio of trunk length (distance between shoulder and hip joints measured along the vertebral column) to foot size was similar in both species, *Diadectes absitus* and *Orobates pabsti*. Moreover, a third species of diadectid was recently introduced from the same site (*Diadectes dreigleichenensis*), putting into question the straightforward ichnospecies-species correlation. To infer the likely sequence of footfalls that defines the gait pattern of the track producer, the skeletal proportions

of *Diadectes absitus* and *Orobates pabsti* were put in relationship to the footprint proportions and trackway pattern of *Ichniotherium sphaerodactylum*. Based on a large sample of *Ichniotherium sphaerodactylum* trackways from the Tambach Formation and assuming different degrees of lateral trunk bending and of flesh cover for fitting the autopodia into the footprints, we find that the skeletal proportions of both possible producers support a lateral sequence walk or even a pace gait instead of a common walking trot (the latter was assumed in previous models of *Orobates pabsti* as the producer of *Ichniotherium sphaerodactylum*). According to our results, the track-trackmaker correlation of *Ichniotherium* should be thoroughly revised and the type of gait as a critical boundary condition for biomechanical modelling should be corrected in future models of diadectid walk.

[Talk] [non-student]

Small reptilian tracks from the middle to late Permian of central Germany

Anna Schöneberger[1], **Michael Buchwitz**[2,*], Lorenzo Marchetti[3], Tom McCann[1] & Jörg W. Schneider[4]

[1]University of Bonn, Bonner Institut für Organismische Biologie, Bonn, Germany;

[2]Museum für Naturkunde Magdeburg, Magdeburg, Germany;

[3]Museum für Naturkunde Berlin, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;

[4]TU Bergakademie Freiberg, Institut für Geologie, Freiberg, Germany;

[*] mbuchwitz@web.de – presenting author

Keywords: Ichnology, trackway, Southern Permian Basin, Rotliegend, Zechstein.

Footprints of small reptiles assigned to the ichnotaxon *Procolophonichnium* were a relatively common element of late Permian and Early Triassic trace fossil assemblages. They are, however, not well known from large samples of trackways – which are necessary if locomotion habits shall be compared – and a considerable part of the previously described material comes from aeolian deposits and can be difficult to interpret. In this study we document material from two central German study areas: (1) the middle to late Permian Mammendorf quarry close to Magdeburg and (2) the late Permian Kupferschiefer mining area of the Sangerhausen Depression, Saxony-Anhalt. The latter includes the playa deposits of the Eisleben Formation, that are accessible in the Wettelrode mine and the Kupferschiefer spoil tips near Morungen. This material is compared to finds from the late Permian Cornberg Sandstone, Hesse and the Early Triassic tracksite of Britten, Saarland. Furthermore, the uppermost Rotliegend to basal Zechstein deposits exposed near Morungen were studied in detail to clarify the depositional environment of these reptile footprint occurrences.

In terms of imprint proportions, morphology and size, the *Procolophonichnium* from the Sangerhausen area is similar to the Mammendorf *Procolophonichnium* specimens but different from the Cornberg and Britten samples. Due to a certain deviation in morphometric features, for the time being we do not assign the Morungen and Mammendorf material to one of the valid

ichnospecies *Procolophonichnium nopcsai* and *Procolophonichnium tirolensis* but consider these specimens as *Procolophonichnium* isp. The trackway patterns of most Mammendorf specimens differ notably from the rest of the sample in their high (normalized) pace length and gauge width, implying a track producer with a different walking style. According to our documentation of the inactive quarry Morungen, the abundant *Procolophonichnium* finds from the spoil tips come from fluvial units that overlie the marine Zechstein conglomerate and underlie a sandy black shale, which is interpreted as the deep-water equivalent of the third cycle of the Kupferschiefer in the typical Zechstein basin facies. Consequently, the track bearing sandstones are terrestrial equivalents of the lower part of the marine Kupferschiefer. The lithological differences between the Röhrig mine of Wettelrode with fully marine and complete Kupferschiefer cycles and the quarry of Morungen (and the nearby spoil tips) lead us to the conclusion that the occurrence of *Procolophonichnium* as a track type of non-marine reptiles is probably related to the temporary persistence of an island in the rapidly flooded Zechstein Sea.

[Talk] [student]

Evidence of osteological correlates for soft tissue in Crocodylia and implications for transoceanic dispersal within Crocodyliformes

Paul M. J. Burke[1,*], Carly C. Pligersdorffer[1,2] & Philip D. Mannion[1]

[1] Department of Earth Sciences, University College London, Gower Street, London, United Kingdom;

[2] School of Geosciences, University of Edinburgh, James Hutton Road, Edinburgh, United Kingdom;

[*] paul.burke.21@ucl.ac.uk – presenting author

Keywords: Crocodylia, CT scanning, gavialoids, saltwater tolerance, transoceanic dispersal.

Crocodylia comprises approximately 25 extant species of alligators, caimans, crocodiles, and gharials. Currently restricted to the tropics, their 80-million-year-fossil record documents a global distribution, including taxa recovered from shallow marine deposits. However, extant crocodylians are commonly known to frequent freshwater environments, with only the Australian crocodyloid *Crocodylus porosus* known for frequenting saltwater environments. Recent morphological phylogenetic analyses have recovered closely related gavialoids from both sides of the Atlantic, and fossil specimens of extant crocodyloid taxa, such as *Crocodylus rhombifer*, have been recovered across various islands in the Caribbean that are separated by oceanic barriers. This suggests that some species of Crocodylia were once capable of transoceanic dispersal. Despite evidence of lingual salt glands in some extant crocodyloids, there has been no documentation of morphological features to support this hypothesis in gavialoids. Based on CT scan data, we reconstructed the internal cranial anatomy of several extinct and extant crocodylians. This reveals several lines of evidence supporting capability for transoceanic dispersal. Most notably, we identify concave depressions on the internal surface of the prefrontals in several taxa across Crocodylia, including the Late Cretaceous–early Paleogene 'thoracosaurs', as well as some Miocene gavialoids, and recent crocodyloid species.

These concave depressions are osteological correlates for nasal salt glands in extant marine reptiles, iguanas, and seabirds. Additionally, they have also been interpreted as such in thalattosuchian crocodyliforms, for which a marine lifestyle is unequivocal. Our preliminary conclusions suggest the capability of salt excretion, and therefore transoceanic dispersal, is potentially ancestral for Crocodylia. Across Crocodyliformes, we note species hypothesised to possess salt glands and suggest that saltwater tolerance has evolved convergently throughout the group. Our results open up the possibility of implementing diceCT methodologies to extant crocodyloid taxa to look at the relationship of the soft tissue associated with these concave depressions.

[Poster] [student]

Insights into the bone microanatomy of the Late Cretaceous island-dwelling ankylosaurian dinosaur *Struthiosaurus austriacus*

Alina Buschhaus[1,*], Sebastian Stumpf[2,3] & Elżbieta M. Teschner[4]

[1] University of Bonn, Institute for Organismic Biology, Department of Palaeontology, Bonn, Germany;

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

[3] University of Vienna, Institute for Palaeontology, Vienna, Austria;

[4] University Opole, Opole, Poland;

[*] s62abusc@uni-bonn.de – presenting author

Keywords: Dinosauria, Ankylosauria, Late Cretaceous, palaeohistology.

The ankylosaurian dinosaur *Struthiosaurus* is one of numerous terrestrial vertebrates that inhabited the Late Cretaceous European archipelago, with fossil occurrences documented from Campanian to Maastrichtian strata of Austria, France, Spain, and Romania. Additionally, material from Hungary suggests that the stratigraphic range of *Struthiosaurus* may extend down into the Santonian. Comprising three currently recognized species and traditionally included in the family Nodosauridae, *Struthiosaurus* is widely regarded as one of the smallest known ankylosaurs, with an estimated body mass of approximately 130 kg. The type species, *Struthiosaurus austriacus*, is known from abundant skeletal remains recovered during the 19th century from lower Campanian deposits of Austria, representing at least three individuals of varying sizes, likely ranging from subadult to adult stages. Although minor morphological differences among overlapping skeletal elements are thought to result from preservation or ontogenetic variation, they may nonetheless indicate the presence of more than one ankylosaurian species in the lower Campanian of Austria. To help unravel this conundrum, long bones referred to *S. austriacus*, representing different size categories, along with one rib, were subjected to a histological analysis in order to determine their ontogenetic stages. All sampled specimens exhibit a near-complete absence of primary bone, which is restricted to the outermost cortex and patches between secondary osteons. A moderate to low degree of vascularization,

predominantly consisting of longitudinal vascular canals, is consistent across all samples. Most specimens show a mixture of predominantly parallel-fibered and woven bone, and advanced bone remodelling is indicated by the presence of secondary osteons. Lines of arrested growth could not be observed in all sampled specimens. Our histological analysis reveals the presence of different ontogenetic stages within the material referred to *Struthiosaurus austriacus*. The smaller bones likely represent subadult individuals, whereas the larger, though more fragmentary, bones exhibit characteristics of adult or near-adult individuals. This supports the hypothesis that the size variation among specimens reflects different ontogenetic stages. Since only the complete but smaller long bones have been used for a body mass estimation, it can be assumed that adult individuals of *Struthiosaurus austriacus* would have attained a much higher body mass. The present results offer promising clues that help clarify European Late Cretaceous ankylosaurian diversity and evolution, providing a crucial basis for future comparative and histological work on island-dwelling dinosaurs.

[Talk] [student]

New anatomical information about the Spanish Upper Triassic simosaurid *Paludidraco multidentatus* (Sauropterygia) based on an unpublished relatively complete postcranial skeleton

Alberto Cabezuelo-Hernández[1,*], Carlos de Miguel Chaves[1], Francisco Ortega[1] & Adán Pérez-García[1]

[1] Grupo de Biología Evolutiva, Dpto. de Física Matemática y de Fluidos, Facultad de Ciencias, UNED, Madrid, Spain;
[*] paleo.alb@gmail.com – presenting author

Keywords: Eosauropterygia, Simosauridae, El Atance, Late Triassic, lower Carnian.

Paludidraco multidentatus (Sauropterygia, Simosauridae) was established based on a relatively complete and articulated skeleton (the holotype), including cranial and postcranial elements, and on a second skull (the paratype), from the Julian (early Carnian, Late Triassic) of El Atance fossil site (Guadalajara, central Spain). No additional individual attributable to this taxon has subsequently described. Despite the relatively good preservation of the holotype, the lack of some elements in this specimen (i.e., the middle-to-distal caudal region, zeugopodial and autopodial elements), or the partial preservation of others (i.e., coracoids, ilia, pubes, gastralia, or the proximal caudal region) have not allowed to know the complete anatomy of its postcranial skeleton. In this context, an as yet unpublished specimen attributable to *Paludidraco multidentatus*, from its type locality, is presented here. The new specimen consists in a relatively complete and partially articulated postcranial skeleton, that is more robust and about 20% larger than the holotype. It preserves elements corresponding to the cervical, dorsal, sacral and proximal caudal regions; both pectoral and pelvic girdles; forelimb and hindlimb remains (including zeugopodial bones); and a well-preserved set of articulated gastral elements. As in the holotype, the new individual preserves most of its articulated dorsal region, lacking most cervical and caudal bones, although the caudal region is identified as more complete than that in the holotype. We provide a preliminary anatomical description of the skeletal elements of the

new individual of *Paludidraco multidentatus*, with special emphasis on those that provide anatomical characters hitherto not documented for this taxon (i.e., zeugopodial elements), and on those previously poorly known (i.e., proximal regions of both pectoral and pelvic girdle elements, caudal vertebrae and ribs, gastralia, ilia), as well as on those recognized as intraspecifically variable when it is compared with the holotype.

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[Poster] [non-student]

Tetrapod tracks from the Devět Křížů quarry (Czech Republic): New insights into Late Triassic tetrapod palaeobiodiversity of the Vindelic land

Gabriela Calábková[1,*], Radek Mikuláš[2], Boris Ekrt[3], Martin Souček[3] & Vojtěch Nosek[4]

[1] Department of Geological Sciences, Faculty of Science, Masaryk University, Brno, Czech Republic;

[2] Institute of Geology, Academy of Sciences of the Czech Republic, Prague, Czech Republic;

[3] Department of Palaeontology, National Museum, Prague, Czech Republic;

[4]Department of Archaeology and Museology, Faculty of Arts, Masaryk University, Brno, Czech Republic;

[*] gcalabkova@sci.muni.cz – presenting author

Keywords: Footprints, Dinosauria, Cynodontia, Bohdašín Formation, Triassic.

The Devět Křížů quarry is a well-known locality because of the discovery of a tridactyl footprint, which was first described in 1998 and attributed to a theropod dinosaur. This dinosaur footprint was found in kaolinitic quartz sandstones in the upper part of the Bohdašín Formation (Krkonoše-Piedmont Basin), located in the northern part of the Vindelic land. The age of the formation was originally considered Early Triassic based on sedimentological studies. However, such dating is inconsistent with the presence of dinosaur footprints, as the Early Triassic period does not support their occurrence.

To date, dozens of invertebrate and vertebrate tracks have been documented in the quarry, including several tridactyl footprints assigned to *Anomoepus* isp. and *Kayentapus* isp., as well as numerous trackways attributed to *Dicynodontipus* isp., all of which are identified here for the first time. The first two mentioned ichnotaxa are primarily found in the Lower Jurassic and less frequently in the Upper Triassic deposits. The trackmakers of the *Anomoepus* tracks are considered to be early ornithischians, whereas the *Kayentapus* tracks were probably made by smaller theropods. Despite this, the Early Jurassic age of the locality seems unlikely, given the

presence of cynodont therapsid tracks assigned to the ichnotaxon *Dicynodontipus*, which has never been found in Jurassic deposits. Therefore, based on tetrapod footprint biostratigraphy, we consider the upper part of the Bohdašín Formation to be the Late Triassic in age.

The Late Triassic was a crucial epoch for the evolutionary radiation of various tetrapod groups, including, among others, dinosaurs, mammaliaforms, crocodyliforms, lissamphibians, and lepidosaurs. However, the ichnological record of some tetrapod groups from this epoch remains relatively limited compared to the body fossils; notably, therapsid tracks are only rarely preserved. The ichnofossils from the Bohdašín Formation thus provide valuable new insights into the palaeobiodiversity and palaeogeographic distribution of terrestrial tetrapods during the Late Triassic.

[Talk] [student]

Comparative palaeoneurological study of three fossil *Canis* (Carnivora, Canidae) species from the Early Pleistocene: possible ethological-palaeoecological inferences

Nicola Calcabrini[1,*], Saverio Bartolini-Lucenti[1], Lorenzo Rook[1], Samuele Frosali[1] & Joan Madurell-Malapeira[1]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;
[*] Nicola.calcabrini@edu.unifi.it – presenting author

Keywords: Canidae, palaeoneurology, virtual palaeontology, Pleistocene.

Studies on the neurology of Canidae in the literature are lacking and obsolete. The first to investigate brain morphology was Radinsky in the 1970s, who developed a method of reconstructing brain endocasts through silicone rubber casts. However, this approach presented some critical problems. As technologies have progressed, virtual palaeontology has opened up new opportunities, allowing virtual reconstructions of endocasts that perfectly reflect the external morphology of the brain, including details such as cranial nerves, blood vessels, sulci and gyri.

The endocranial casts of three fossil species (*Canis etruscus*, *Canis borjgali*, and *Canis mosbachensis*) were compared with those of the extant species. The morphological observations of the *sigmoideus gyrus* (extremely diagnostic for the Family Canidae) of the extant species were consistent with the attribution to the genus *Canis* suggested in the literature, with the exception for the genus *Lupulella*. Analysis of the frontal area, which in Carnivora is proven to be related to sociality, revealed interesting results. In the subtribe Canina, sociality is generally high. Two main groups are distinguished: canids that hunt cooperatively, such as *Canis lupus* and *Lycaon pictus*, and jackal-like species like *Canis aureus*, *Canis lupaster*, *Lupulella mesomelas* and *Lupulella adusta*. The former show higher values of the ratio between frontal area and total brain volume opposed to solitary species, like those of the second group. The results for the fossils showed that *Canis etruscus* had an ecology similar to that of jackal-like species, with a remarkable morphological similarity to *Lupulella adusta.* On the contrary the morphology of *Canis borjgali* and *C. mosbachensis* resembles that of the genus *Canis*, confirming their systematic interpretation. Remarkably, *C. borjgali* had a high sociality similar to group-hunters species. Moreover, considering the evidence as a whole, we can say that it is close to the features of *Canis lupus*.

[Talk] [student]

The Ypresian fish-bearing *Lagerstätten* of Solteri and Monte Solane: a first glimpse into the palaeobiodiversity and evolution of mesopelagic environments

Pietro Calzoni[1,*], Luca Giusberti[1], Eliana Fornaciari[1], Valeria Luciani[2], Flavia Boscolo-Galazzo[3] & Giorgio Carnevale[4]

[1] Dipartimento di Geoscienze, University of Padova, Padova, Italy;
[2] Dipartimento di Fisica e Scienze della Terra, Polo Scientifico-Tecnologico, University of Ferrara, Italy;
[3] Bremen University, MARUM, Center for Marine Environmental Sciences, Bremen, Germany;
[4] Dipartimento di Scienze della Terra, University of Torino, Turin, Italy;
[*] pietro.calzoni@phd.unipd.it – presenting author

Keywords: Teleostei, Ypresian, bathyal, new taxa, Eocene.

In the early Paleogene, Earth's climate was characterized by periods of marked global warming, such as the Early Eocene Climatic Optimum (EECO; ca. 53–49 Ma) and the so-called "hyperthermals" (e.g., Paleocene–Eocene Thermal Maximum; ca. 56 Ma), which had profound consequences on both marine and terrestrial biota. In marine ecosystems, these events heavily impacted higher trophic levels, including fish communities. The lower Paleogene stratigraphic record of northeastern Italy includes some lower Eocene *Konservat-Lagerstätten* with a variety of extremely well-preserved fishes, such as the much-celebrated Ypresian shallow water sites of Monte Postale and Pesciara of Bolca (Verona and Vicenza provinces). Other fish-bearing *Lagerstätten* that were discovered in northeastern Italy are Monte Solane (Verona province) and Solteri (Trento province), respectively in the early 2000s and in the late 1970s. These pelagic sites, ascribed to the upper part of the Ypresian, are not only geographically close but also almost coeval to the Pesciara and Monte Postale sites of the Bolca *Lagerstätte*, representing their mesopelagic counterpart. Our research focused on analysing almost 500 specimens of deep-water bony fishes that were retrieved from both sites and that were never investigated in

order to characterize the palaeobiodiversity of the Tethyan mesopelagic environment. These ichthyofaunas primarily consist of mesopelagic taxa such as stomiiforms (Gonostomatidae and Phosichthyidae) and subsequently myctophiforms (Myctophidae) and percomorphs (Centrolophidae, Euzaphlegidae, Gempylidae, Trichiuridae), all represented by new and still undescribed taxa. The stratigraphic relationship between the Solteri and Solane sites has also been investigated since these are two of the world's oldest fish-bearing pelagic *Lagerstätten* of the Paleogene. Both these sites are extremely relevant not only because of their age, which gave interesting insights into the evolution of several deep-water taxa, but also because they provide a unique opportunity to unravel the structure of the mesopelagic fish assemblages of the western Tethys during the demise of the Early Eocene Climatic Optimum (EECO; ca. 53–49 Ma), the longest warm phase of the Cenozoic Era.

Funding: Funding provided by University of Padova.

[Poster] [non-student]

The skull of *Dicraeosaurus hansemanni* (Dinosauria, Sauropoda) from the Late Jurassic of Tendaguru, Tanzania

Amy Campbell[1,*] & Daniela Schwarz[1]

[1] Museum für Naturkunde, Berlin, Germany;

[*] amy.campbell@mfn.berlin – presenting author

Keywords: Sauropoda, Dicraeosauridae, cranial anatomy, digitisation.

Dicraeosaurids are unusual sauropod dinosaurs that are characterised by their small size, short necks with elongated neural spines, and robust skulls, compared to other sauropod groups. The skull material of *Dicraeosaurus hansemanni* from Tendaguru comprises tooth bearing elements, two braincases, and additional circumorbital bones, and is among the best-preserved skull remains within Dicraeosauridae. Since its original description by Werner Janensch in 1936, nine further taxa have been ascribed to Dicraeosauridae, with the first of these being *Amargasaurus cazaui* in 1991. The long gap between the discoveries further cements the need for an updated description. Here we present a new reconstruction of the skull of *Dicraeosaurus hansemanni*. Cranial elements were digitised using photogrammetry, digitally reassembled, and subsequently 3D printed, which has allowed us to determine certain bones that articulate and belong to a single individual. Missing elements have been reconstructed based on skulls of other diplodocoid sauropods. The high number of dicraeosaurid species preserving skull material offers a unique opportunity to understand the feeding ecologies of these enigmatic dinosaurs. The extremely robust skull of *Dicraeosaurus* significantly deviates from that of other dicraeosaurids and diplodocids, and together with its short neck, it is indicative of a specialized ecology and dietary preferences, in particular with regard to the ecological variety within the sauropod fauna in the Middle Dinosaur Member of the Upper Jurassic Tendaguru Formation.

[Talk] [non-student]

Tracking perissodactyls across the Eocene/Oligocene transition in the Jaca Basin (Pyrenees, Spain)

Diego Castanera[1,*], Miguel Moreno-Azanza[1], José Ignacio Canudo[1] & Aránzazu Luzón[2]

[1] Grupo Aragosaurus-IUCA, Facultad de Ciencias, Universidad de Zaragoza, Zaragoza, Spain;

[2] Grupo GEOtransfer-IUCA, Facultad de Ciencias, Universidad de Zaragoza, Zaragoza, Spain;

[*] dcasta@unizar.es – presenting author

Keywords: Ichnites, Vertebrates, Palaeotheriidae, Priabonian, Rupelian.

The Jaca-Pamplona Basin (Pyrenees, North of Spain) is a key area for the study of vertebrate ichnofaunas across the Eocene–Oligocene transition. During this time interval a faunal turnover, known as the "Grande Coupure", occurred. In Europe, this was characterized by the replacement of endemic mammal faunas by new immigrants of Asian origin. Several fluvial to transitional lithostratigraphic units in this basin have yielded tracksites with mammal and bird footprints. In the last years, new unpublished localities have been found in the aragonese area of the basin (Huesca province) that provide outstanding information on the mammals ichnoassemblages across the Priabonian-Rupelian transition. Four tracksites have been found in the Campodarbe Group in the localities of Bailo (Cantera Arrés tracksite, Priabonian, Yeste-Arrés Unit), Santa Cruz de la Serós (Riorcal tracksite, Priabonian, Campodarbe Formation), Ruesta (Río Regal tracksite, Priabonian, Liédena Sandstone Unit) and Anzánigo (Km. 29 tracksite, Rupelian, Campodarbe Formation). These tracksites have yielded ichnoassemblages mainly produced by phytophagous mammals such as perissodactyls and artiodactyls, with sporadic occurrences of carnivoramorphs. The tracks are preserved in sandstone layers as concave epireliefs and convex hyporeliefs. In this communication, we focus on the perissodactyl tracks, characterized for being tridactyl, mesaxonic, symmetric and almost as wide as long. The ichnites have three rounded digits, including a central large and robust digit and two lateral digits that are smaller and gracile. The ichnites show notable morphological

similarities between the tracksites, especially in the overall shape, but also significant differences especially in divarication angles and size (tracks range from 4 cm to more than 10 cm in length). The former can be explained as possible differences in the autopods (differences in manus and pes shape) and autopod-substrate interaction. Further work is needed to understand whether the variation in size may represent different trackmaker species or ontogenetic factors (at least within the same tracksite). The morphology of the tracks is reminiscent to *Plagiolophustipus*-like tracks described in the nearby Ebro Basin (Spain), including the type ichnospecies *Plagiolophustipus montfalcoensis* from the early Oligocene of Montfalcó d´Agramunt (Lleida). These types of tracks have been traditionally assigned to equoids of the family Palaeotheriidae, a group of perissodactyls with several species identified in the late Eocene/early Oligocene of the Iberian Peninsula. This analysis represents a first step to understand the perissodactyl ichnoassemblages across the Eocene/Oligocene transition in the Iberian Peninsula, offering new insights on possible ichnoassociation changes and on the perissodactyl faunal turnover in Europe.

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[Poster] [non-student]

The reptiles from the end of the middle Eocene (MP 16) of Lavergne in the Phosphorites du Quercy, France

Andrej Čerňanský[1,2,*], Georgios L. Georgalis[3], Maeva Orliac[4] & Jeremy Martin[5]

[1] Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland;
[2] Department of Ecology, Laboratory of Evolutionary Biology, Faculty of Natural Sciences, Comenius University in Bratislava, Bratislava, Slovakia;
[3] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;
[4] Institut des Sciences de l'Évolution de Montpellier, Université de Montpellier, CNRS, IRD, EPHE, Montpellier, France;
[5] University of Lyon, UCBL, ENSL, CNRS, Villeurbanne, France;
[*] cernansky.paleontology@gmail.com – presenting author

Keywords: Squamata, lizards, snakes, Crocodylia, climate.

The Phosphorites du Quercy are phosphatic clays found in karstic fillings in the limestone plateaux of the Quercy in southern France. This area is also regarded as lagerstätte due to the excellent preservation of fossils, including even natural mummies. Although the fossil bones are usually disarticulated, they are three dimensionally preserved (in contrast to Messel and Geiseltal). The Eocene represents an important time in the Earth's Cenozoic climate evolution. Terrestrial ecosystems in Europe, but practically in the entire world, changed dramatically during the Paleogene due to global climatic changes. Global climate cooling from greenhouse to icehouse conditions occurred during the Eocene Epoch, characterized by incipient polar ice-sheet formation. Reptiles provide an ideal exemplar group for a detailed integrated study of the tetrapod past climate indicators such as the annual temperature and precipitations. Reptile faunas from the late middle Eocene of Europe are, however, rare. We here present material of lizards, snakes, and crocodiles from the Lavergne locality (MP 16) in Quercy region (France). Reptiles in Lavergne are diverse and several major clades can be identified: Gekkota, Scincidae, Lacertidae, Pleurodonta, Glyptosauridae, Anguidae, Palaeovaranidae, Serpentes, and

Crocodylia. The presence of two scincids (this clade is for the first time documented from Lavergne), one of them representing a new taxon, shows a suitable environment for this clade. Snakes are diverse, represented by the large messelopythonid *Palaeopython*, the putative ungaliophiid *Dunnophis*, certain other distinct morphotypes of Constrictores, plus the enigmatic alethinophidian *Cadurceryx*. Squamate faunas indicate relatively warm temperatures as demonstrated by the presence of thermophilic taxa. The same is true for crocodiles (note that reports of their remains from the Quercy area are rare). Lavergne is of the same age as the locality Le Bretou in France and Mazaterón in Spain, all of which yielded somehow similar (but not identical) faunas. Overall, the European squamate fauna of MP 16 does not seem to be highly different from those from MP 14 or MP 17. In regard to squamates, no faunal reorganization or any significant extinction event can be recognized at the middle – late Eocene boundary in Europe. In fact, larger differences and faunal changes can be clearly recognizable when the early Eocene assemblages are considered. Thus, our data support suggestions that although temperatures decreased relative to the previous stages of the Eocene, rich and diverse herpetofaunas are documented from the end of the middle Eocene (MP 16) as well as the late Eocene (MP 17–MP 19+20).

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[Talk] [non-student]

The evolution of chameleons (Squamata, Chamaeleonidae) revealed by three-dimensionally preserved fossils from Africa

Andrej Čerňanský[1,2,*], Job M. Kibii[3] & Thomas Lehmann[4]

[1] Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland;
[2] Department of Ecology, Laboratory of Evolutionary Biology, Faculty of Natural Sciences, Comenius University in Bratislava, Bratislava, Slovakia;
[3] University of the Witwatersrand, Johannesburg, South Africa;
[4] Senckenberg Research Institute and Natural History Museum Frankfurt, Department of Messel Research and Mammalogy, Frankfurt am Main, Germany;
[*] cernansky.paleontology@gmail.com – presenting author

Keywords: Squamata, Iguania, Miocene, computed tomography.

Chamaeleonidae represents an unusual clade of lizards including species from Africa, Madagascar, the Middle East, southern India, Sri Lanka, and the Mediterranean region of Europe. Both molecular and palaeontological evidence suggest that the clade originated in continental Africa. Although molecular data point to a Cretaceous origin for chameleons, their fossil record does not predate the Neogene. Even the Miocene fossil record of these popular reptiles is scant and the vast majority of the known fossils is represented by isolated elements. Nevertheless, exceptions do exist: *Chamaeleo andrusovi* from the Miocene of Europe is based on well-documented isolated cranial elements. Moreover, two spectacularly preserved specimens have also been documented from Miocene Africa. The first is the remarkably three-dimensionally preserved skull of *Calumma benovskyi* from the Early Miocene of Rusinga Island, Kenya. This taxon challenged the long-held view that chameleons originated on Madagascar and dispersed later to Africa by forming a strong evidence of an African origin for Malagasy lineages. The second is "*Chamaeleo*" *intermedius* from the Middle Miocene of Fort Ternan in Kenya. Its skull and anterior part of the body are preserved in 3D within a natural calcite cast, revealing fine details of its skin. It represents the only known Miocene chameleon mummy and one of the best preserved chameleon fossils ever recovered. The holotype and only

known specimen of this taxon was briefly studied by Hillenius almost half century ago and described as a new species of *Chamaeleo*. Hillenius suggested that it might be primitive, representing a "missing link" between the group around the common chameleon (*Chamaeleo chamaeleon*) and those around the side-striped chameleon (now placed into the genus *Trioceros*). Later, however, this intermediate position was rejected by several researchers including Estes and Klaver, who argued that the fossil fits neatly into the genus *Chamaeleo* and does not represent a transitional form. However, most of its bones are covered by calcified skin and are hidden inside the rock matrix, hindering a detailed anatomical study. Using μCT, we here present the first detailed study of this mummy. For the first time, the skull and skeleton of this important specimen are described in detail and compared to extant taxa. Our study, including also a phylogenetic analysis of Chamaeleonidae, sheds a completely new light on the affinities of this fossil. Finally, this mummy offers a rare glimpse into the external appearance of an extinct chameleon species from the Miocene.

[Talk] [non-student]

Gondwanan dominance of chigutisaurids (Temnospondyli) after the Carnian Pluvial Episode - bone resilience: histology and growth

Sanjukta Chakravorti[1,*], Elzbieta Teschner[2], Dhurjati Sengupta[3] & Dorota Koneitzko Meier[1]

[1] Department of Palaeontology, Staatliches museum fur Naturkunde, Stuttgart, Germany;
[2] Institute of Biology, University of Opole, Opole, Poland;
[3] Geological Studies Unit, Indian Statistical Institute, Kolkata, West- Bengal, India;
[*] sanjukta.chakravorti@smns-bw.de – presenting author

Keywords: *Compsocerops*, Chigutisauridae, histology, Carnian Pluvial Episode (CPE), India.

The Carnian Pluvial Episode (CPE; ~234–232 Ma) marked a period of significant climatic upheaval and biotic turnover, leading to the decline of dominant aquatic temnospondyls such as metoposaurids. In this ecological vacuum, chigutisaurids rapidly diversified across Gondwana. Despite their evolutionary success, the palaeohistology of this clade remains largely unexplored. This study presents the first comprehensive histological investigation of *Compsocerops cosgriffi* from the Upper Triassic Maleri Formation (India), based on thin-sectioned humeri, ribs, intercentra, and an ilium. Using modified standard protocols and polarized light microscopy, we assess growth dynamics and skeletal tissue architecture to infer ecological and developmental strategies. A consistent and striking feature across all elements is the presence of a very thick annuli - indicative of intermittent slow growth phases - superimposed on rapidly deposited parallel-fibered primary bone. This “fast-slow” growth pattern contrasts with the cyclical, seasonally paced growth seen in metoposaurids such as *Panthasaurus maleriensis*, which display avascular ribs and pronounced Lines of Arrested Growth (LAGs). Humeri of *Compsocerops* are highly remodelled with extensive cortical porosity but retain alternating zones and annuli. Ribs exhibit well-vascularized parallel-fibered bone, suggesting sustained rapid growth under aquatic conditions. The intercentrum, although heavily diagenetically altered, preserves remnants of periosteal cortex and trabecular organization. The ilium, a dermal bone, displays a diploë-like structure with dense Sharpey’s fibres, indicative of strong muscular or ligamentous attachment and functional load bearing.

We hypothesize that the recurring annuli represent a vestigial signature of metamorphic regulation, reflecting physiological plasticity in a lineage with no clear evidence of a larval stage. This developmental flexibility, combined with an ability to grow rapidly during favourable windows, likely enabled chigutisaurids to outcompete slower-growing taxa in post-CPE ecosystems. Our findings suggest that chigutisaurid growth was decoupled from environmental cyclicity, reflecting a more opportunistic and ecologically responsive strategy. The combination of histological innovation and life history plasticity highlights *Compsocerops* as a model for studying vertebrate recovery and adaptation following climatic crises. This work emphasizes the power of bone microstructure to reveal deep-time survival strategies and sheds light on the role of amphibians in reshaping Gondwanan freshwater ecosystems after mass extinction events.

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[Talk] [non-student]

Morphological variation and craniofacial allometry in feliform carnivorans

Narimane Chatar[1,*], Davide Tamagnini[2], Margot Michaud[3,4], Galina Lapp[1], Kai Peters[1], Martin Kyle Drennen[1], Catherine Jimin Kim[1], Kizziah Katherine Skei Singer[1] & Z. Jack Tseng[1]

[1] Functional Anatomy and Vertebrate Evolution Lab, Department of Integrative Biology University of California Berkeley, Berkeley, United States of America;
[2] Department of Biology and Biotechnologies, Sapienza University of Rome, Roma, Italy;
[3] Institut Polytechnique UniLaSalle, Université d'Artois, IDEALISS, Mont-Saint-Aignan, France;
[4] Departement Formation et Recherche Sciences et Technologie, Université de Guyane, Cayenne 97300, Guyane;
* Narimane.chatar@berkeley.edu – presenting author

Keywords: Carnivora, Feliformia, allometry, geometric morphometris, CREA.

With over 260 recognized extant species, the order Carnivora is one of the most diverse mammalian groups today, with a history tracing back approximately 60 million years. Crown carnivorans are divided into two suborders: Feliformia (cats, genets, hyenas, mongooses, etc.) and Caniformia (dogs, bears, raccoons, weasels, skunks, seals, etc.). Among the evolutionary trends shaping phenotypic diversity over macroevolutionary scales, Craniofacial Evolutionary Allometry (CREA) describes a pattern in which smaller species tend to have proportionally shorter faces and larger braincases. CREA has been documented in two caniform families (Canidae and Mustelidae) and one feliform family (Herpestidae), but not in Felidae. While feliforms generally exhibit shorter faces than caniforms, the reasons behind the felids' deviation from the CREA pattern remain unclear. A large-scale study quantifying allometry in both fossil and living feliforms might provide key insights into this question.

We collected 3D landmark data from 112 specimens representing 49 species of extant and extinct feliforms and stem groups. Using 3D geometric morphometrics, we quantified cranial morphological variation and tested for allometric patterns within and across feliform families. Our preliminary results show weak allometric signals overall, with the strongest allometric

relationship (highest adjusted R^2) found in Felidae. Regressions of facial versus braincase size against centroid size were also weak. The lowest allometric signals are observed in Nimravidae and Viverridae, but are also very weak in Hyaenidae. These preliminary results suggest that feliform carnivorans tend to deviate from the CREA pattern, highlighting the complexity of morphological disparity in Feliformia. As previously suggested in the literature, CREA is not universal, and the evolution of skull shape likely reflects a balance between functional adaptation (e.g., feeding ecology, ecological specialization) and developmental constraints, modularity, or evolutionary rates, which may obscure craniofacial allometry.

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[Talk] [non-student]

Re-description of the Mongolian sauropod dinosaur *Opisthocoelicaudia skarzynskii* clarifies titanosaur macroevolution and dispersal during Cretaceous hyperthermal events

Alfio Alessandro Chiarenza[1,2,*], Lindsay Zanno[2,3], Tsogtbaatar Chinzorig[2,3,4], Verónica Díez Díaz[5], Buuvei Mainbayar[4], Haruo Saegusa[6†], Paul Upchurch[1] & Philip D. Mannion[1]

[1] Department of Earth Sciences, University College London, London, United Kingdom;
[2] North Carolina Museum of Natural Sciences, Raleigh, North Carolina, USA;
[3] Department of Biological Sciences, North Carolina State University, Raleigh, USA;
[4] Institute of Palaeontology, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia;
[5] Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[6] Institute of Natural and Environmental Sciences, University of Hyogo, Sanda, Hyogo, Japan;
[†] deceased;
[*] a.chiarenza15@gmail.com – presenting author

Keywords: Sauropodomorpha, Cretaceous, Mongolia, Titanosauria, palaeobiogeography.

Understanding dinosaur biogeographic and macroevolutionary responses to Mesozoic climatic events provides fundamental insights into the long-term dynamics shaping terrestrial ecosystems. Among sauropod dinosaurs, the latest Cretaceous Mongolian titanosaur *Opisthocoelicaudia skarzynskii* represents a key taxon due to its unique Northern Hemisphere distribution, contrasting with the predominant Gondwanan distribution of Titanosauria. Titanosaurs seemingly experienced their highest diversification rates during the Cretaceous, encompassing a temporal transition coinciding with significant climatic fluctuations, including major hyperthermal events, such as the Selli Event in the Aptian (120.5 Ma), the Cretaceous Thermal Maximum (KTM) around the Cenomanian–Turonian (94–91 Ma), and the late Maastrichtian warming event (66 Ma), respectively. These events provided extraordinary selective pressures and dispersal opportunities, potentially influencing titanosaur evolution and geographic distribution. We undertook a detailed redescription of *Opisthocoelicaudia*

skarzynskii using advanced surficial scanning technologies and high-resolution photographic imaging of its holotype specimen. This clarified previously ambiguous anatomical characteristics, improving comparability across a comprehensive morphological dataset of macronarian sauropods. This dataset was enriched by integrating numerous titanosaur discoveries reported over the past five decades. Precise morphological character coding facilitated rigorous specimen-level phylogenetic analyses using maximum parsimony and Bayesian inference, resulting in the most comprehensively sampled sauropod phylogeny to date, significantly refining our understanding of titanosaur interrelationships and evolutionary histories. Leveraging this robust phylogenetic framework, detailed biogeographic analyses were conducted using the R package BioGeoBEARS to rigorously evaluate dispersal pathways for Eurasian titanosaurs. *Opisthocoelicaudia* was systematically compared with closely related taxa from diverse regions, including North America (i.e. *Alamosaurus*), South America (e.g. *Saltasaurus*), and Africa (e.g. *Mansourasaurus*). We tested competing hypotheses concerning the origin of Asian titanosaurs, examining scenarios of Gondwanan emigration versus endemic Eurasian evolution, and assessing conflicting scenarios of North American recolonisation during the late Maastrichtian warming event by integrating phylogenetic inference and palaeoclimatic modelling. Palaeoclimatic simulations calibrated with fossil occurrences and coupled with phylogenetic comparative methods highlighted the impact of hyperthermal events, notably the KTM. These analyses identified temperature variability as critical drivers influencing titanosaur diversification dynamics and trait evolution, including body size, dietary specialization, and climatic niche occupation. Integrating anatomical, phylogenetic, biogeographic, and climatic data, our study significantly advances understanding of how large-bodied terrestrial vertebrates respond to rapid climatic shifts. This advancement on the holotype specimen of *Opisthocoelicaudia skarzynskii* provides broader ecological and evolutionary insights into biotic responses to hyperthermal events over deep geological timescales in a major clade of large-bodied, terrestrial tetrapods.

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[Poster] [non-student]

Heosemys mossoczyi, a puzzling geoemydid turtle (Testudines) from the Pliocene of Poland

Milan Chroust[1,*], Tomasz Szczygielski[1] & Georgios L. Georgalis[2]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[2] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Krakow, Poland;

[*] chroust@twarda.pan.pl – presenting author

Keywords: Turtles, Pliocene, Central Europe, Geoemydidae.

The fossil geoemydid freshwater turtle *Heosemys mossoczyi* is revised based on the holotype and referred material, consisting of almost 300 specimens. The material originates from three Pliocene localities, namely Rębielice Królewskie IA (type locality), Węże I, and Zalesiaki, all from south-central Poland and all of Pliocene age. The previous taxonomic attribution to the genus *Melanochelys* can be excluded based on the absence of pointed, long epiplastral processes, absence of three longitudinal keels, and the lateral constriction of the vertebral I. Similarly, affinities to the genus *Mauremys* can be rejected based on the position of the humeropectoral sulcus, which is located more anteriorly on the entoplastron, and by the presence of a less angular anal notch. *Heosemys mossoczyi* can be identified as a derived member of the genus *Heosemys* based on the oval shape of the neural I, the axillary buttress reaching the costal I, the absence of overlap of the marginals V and VI with the plastron, the suture between the pleurals III and IV located between the marginals VIII and IX, and the presence of posterior serration of the carapace periphery. After comparisons with its supposed representatives from other European countries, we can confirm its central to eastern European distribution in the areas of modern-day Poland and Romania, and, tentatively, also in Slovakia and Hungary. Other material historically attributed to this taxon can only be identified to the family level (i.e., Geoemydidae indet.) due to its undiagnostic nature and / or lack of proper documentation of the fossil specimens. The occurrence of *Heosemys mossoczyi* in Central Europe expands the current knowledge of the spatial and temporal distribution of geoemydid

turtles and represents the oldest record of this genus (currently confined to Southeast Asia) worldwide.

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[Talk] [non-student]

A new basal testudinid tortoise (Testudines) from the Early Miocene of Ahníkov (Czechia)

Milan Chroust[1,*], Tomasz Szczygielski[1] & Àngel H. Luján[2]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[2] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Barcelona, Spain;
[*] chroust@twarda.pan.pl – presenting author

Keywords: Turtles, Burdigalian, Central Europe, Testudinidae.

We present a new species of the extant genus *Manouria*, which is considered to be the basalmost testudinid genus. The studied material comes from the Ahníkov I fossil site located in the Most Basin in NW Bohemia (Czechia), dated to the Early Miocene (Burdigalian, MN 3). The material represents the outer rim of the carapace, with mostly preserved anterior and posterior portions and an almost complete plastron. The genus *Manouria* nowadays inhabits only southeastern Asia, and accordingly its biogeography and plausible European origin are discussed. Even if being the oldest member of the clade and having a mixture of characters present in both extant species, as well as in the extinct *Manouria oyamai* from the Pleistocene of Japan, the new Czech species seems to be closely related to *Manouria emys* and more derived than *Manouria impressa*, which seems to be more basal among the clade. Specific environmental requirements of extant *Manouria* spp. allow us to use this taxon as a proxy for a palaeoclimatic reconstruction of the Ahníkov fossil I site, which suggests a broadleaf evergreen tropical wet forest.

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[Talk] [non-student]

Exploring the faunal remains from Kůlna Cave through ZooMS: ecology of the Moravian Karst in the Paleolithic

Weronika Karolina Cieszynska[1,*], Martina Roblíčková[2], Aleš Plichta[2], Petr Neruda[2], Ondrej Šedo[3], Roshan Paladugu[4] & Zuzana Hofmanová[1,4]

[1] Masaryk University, Department of Archaeology and Museology, Brno, Czech Republic;
[2] Moravian Museum, Brno, Czech Republic;
[3] Central European Institute of Technology, Brno, Czech Republic;
[4] Max Planck Institute for Evolutionary Anthropology, Department of Archaeogenetics, Leipzig, Germany;
[*] 253347@muni.cz – presenting author

Keywords: Zooarchaeology by Mass Spectrometry (ZooMS), Neanderthal, Kůlna Cave.

Kůlna Cave, located in South Moravia in the Czech Republic, is a significant palaeontological and archaeological site known for the discovery of Neanderthal cranial remains. In this study, a total of 105 unidentifiable bone fragments were analyzed using Zooarchaeology by Mass Spectrometry (ZooMS). The samples were collected from stratigraphic layer 9b, which dates to the Middle Paleolithic and is associated with artifacts from the Micoquian industry.

Collagen was extracted using an already published protocol for acid-insoluble collagen extraction. The obtained spectra were analyzed using Mascot software alongside manual interpretation. The primary aim of the study was to identify faunal remains that could not be classified through traditional morphological methods.

We managed to identify species for 103 out of 105 analysed fragments. The majority was identified as belonging to the Bovinae and Cervidae (deer) families, followed by horse and reindeer. In addition, a small number of bone fragments were identified as belonging to cave bear (*Ursus spelaeus*) and wolf (*Canis lupus*), although these were significantly less frequent.

The dominance of herbivorous taxa is consistent with the hypothesis that the site was used by Neanderthals, potentially as a seasonal hunting or butchering location. The presence of cave

bear remains is particularly intriguing, as the morphology of Kůlna Cave makes it an unlikely hibernation site. These remains may have been introduced through taphonomic processes or could suggest that bears were also part of the Neanderthal prey.

This study contributes to our understanding of the faunal landscape of the Moravian Karst during the Paleolithic and highlights the utility of ZooMS in enhancing species identification from highly fragmented palaeontological material. Furthermore, the successful application of this method opens the possibility of detecting additional hominin remains in the Kůlna Cave and other caves of Moravian Karst in the future. This may shed more light on the extent and nature of Neanderthal presence in the region.

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[Talk] [non-student]

Redefining Agassiz's *Sauropsis* (Actinopterygii, Pachycormidae): a troublesome taxonomic concept

Samuel L. A. Cooper[1,*] & Erin E. Maxwell[1]

[1] Staatliches Museum fur Naturkunde Stuttgart, Rosenstein 1, 70191, Stuttgart, Germany;
[*] samuel.cooper@smns-bw.de – presenting author

Keywords: *Sauropsis*, Pachycormidae, Actinopterygii, taxonomy, Upper Jurassic.

Pachycormids (Actinopterygii) were a successful group of small to gigantic-sized Mesozoic bony fishes with a near global distribution between the Early Jurassic and latest Cretaceous. They are novel for their high morphological and ecological disparities within the clade, and their key phylogenetic position on the teleost stem (Teleostei). *Sauropsis* Agassiz, 1832 was the first genus of pachycormid to be named, although the taxonomic concept, species diversity, and phylogenetic relationships of this genus remains poorly studied and largely untested. Historically, five species spanning the Early to Late Jurassic have been included in *Sauropsis*, with the genus reflecting a particular grade of fish evolution rather than a true generic assemblage. Redescription of the type species, *Sauropsis longimanus* from the Upper Jurassic of Solnhofen has established a new taxonomic definition for the genus. We propose that only the type species and a second unnamed species from the Upper Jurassic of England should be retained in the genus. The species '*Sauropsis*' *depressus*, also from Solnhofen, is moved to the genus *Simocormus*, whilst the Lower Jurassic species ('*Sauropsis*' *veruinalis*) belongs to a new unnamed genus, whereas the affinities and genus-level placement of '*Sauropsis*' *depressus* and '*Sauropsis*' *woodwardi* require further investigation. The Middle Jurassic *Sauropsis mordax* is an indeterminate aspidorhynchid. *Sauropsis* is constrained to the Upper Jurassic and is here redefined as an elongate pachycormid with a dorsal fin near enough opposed to the anal fin, and possessing 2–3 scale rows per vertebral segment without peg and socket articulation, two distinct lateral lines (lateral and dorsolateral) which converge in the supracleithrum, and a scaly caudal apparatus on the caudal fin. Phylogenetic analysis resolves *Sauropsis longimanus* as an early-diverging hypsocormine, with comments given on its novel implications for the evolution of Pachycormiformes.

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[Talk] [student]

Palaeoecology through biomechanics: digital bite simulations of extant and fossil canids (Carnivora) to understand their feeding habits

Alberto Corridori[1,*], Saverio Bartolini-Lucenti[1,2], Emanuele Peri[1] & Lorenzo Rook[1]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;

[2] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Barcelona, Spain;

[*] alberto.corridori@edu.unifi.it – presenting author

Keywords: *Canis mosbachensis*, stress, bite, palaeoecology, Finite Element Analysis (FEA).

This work aims to investigate the palaeoecology of the extinct Canidae *Canis mosbachensis*. Using the Finite Element Analysis, the bite of *Canis mosbachensis* was simulated to study the mechanical behaviour of its cranium, along with that of a sample of extant canids characterised by different ecologies. The stress results of *C. mosbachensis* were subsequently compared with those found on extant canids to better understand its palaeoecology. The bite simulations were performed using 3D models extracted from CT scans of the species included in this investigation. To explore a wider range of bite scenarios, a bilateral canine bite, a unilateral carnassial bite, and a unilateral bite at the first molar were simulated. According to the resulting von Mises stress patterns, *Canis mosbachensis* appears to display a rather stiff cranial structure, closer to some the living species like *Canis lupus*, both for stress distribution and values. The similarities with *Canis lupus* led to hypothesize that *Canis mosbachensis* might have been a hypercarnivore. The robust cranium observed in *Canis mosbachensis* is probably an adaptation that allowed it to occasionally consume hard parts of its prey. This might be due to the highly competitive environment in which this fossil canid lived. The obtained stress patterns suggest that the frontal sinuses, two cranial cavities typical of Canini, contribute to stress dissipation in a context of a bite at level of the canines. However, such a function does not emerge from the simulations at the carnassial and at the molar.

[Talk] [non-student]

Why there were no non-volant eutherians in early Australia? Introducing the Weddell Line as a Cenozoic biogeographic barrier in Antarctica

Vicente D. Crespo[1,2,*] & Francisco J. Goin[3,4]

[1] Departamento de Ciências da Terra, FCT-UNL Faculdade de Ciências E Tecnologia, GeoBioTec, Universidade Nova de Lisboa, Caparica, Portugal;

[2] Museu da Lourinhã, Lourinhã, Portugal;

[3] CONICET, Consejo Nacional de Investigaciones Científicas y Técnicas, Ciudad Autónoma de Buenos Aires, Argentina;

[4] División Paleontología Vertebrados, Facultad de Ciencias Naturales y Museo de La Plata, Universidad Nacional de La Plata, La Plata, Argentina;

[*] vidacres@gmail.com – presenting author.

Keywords: Weddell Line, Paleogene biogeography, metatherian dispersal, Antarctic palaeogeography, South America-Australia Faunal Exchange.

The dispersal of terrestrial mammals between South America and Australia during the early Cenozoic has long intrigued palaeontologists. In this study, we propose the "Weddell Line" as a new biogeographic barrier that significantly influenced these dispersal patterns. This hypothetical barrier, located south of Marie Byrd Land in West Antarctica, extended across a seaway linking the Weddell and Ross embayments, now concealed beneath massive ice shelves. The Weddell Line likely functioned as a "sweepstakes route", a concept describing infrequent and chance dispersal events across challenging environments. This barrier restricted the movement of eutherian mammals while allowing only small-bodied metatherians to cross.

Palaeogeographic reconstructions suggest that during the Paleogene, West Antarctica and southern South America formed a biogeographic unit, with connections severed by the end of the Paleocene. The absence of eutherians in Australia's earliest terrestrial mammal assemblages,

contrasted with the presence of South American-derived metatherians, aligns with this scenario and highlights the importance of Antarctica in shaping these biogeographic patterns.

Notably, the oldest known Australian fauna, the Tingamarra Local Fauna, exclusively comprises metatherians, with striking affinities to South American lineages. This reinforces the hypothesis of a South American origin for Australian marsupials. The dispersal route from South America to Australia via Antarctica would have required overcoming several critical pathways, and the Weddell Line presents a plausible explanation for the observed faunal composition.

Furthermore, molecular phylogenetics supports a rapid diversification of Australasian marsupials following their arrival, with evolutionary radiations potentially triggered by the ecological opportunities presented in the new environment. The absence of fossil evidence for eutherians in early Australian assemblages suggests that the Weddell Line acted as a selective filter, favoring smaller metatherians capable of surviving the arduous crossing.

The Weddell Line hypothesis offers a new perspective on Southern Hemisphere biogeography, emphasizing the role of Antarctic palaeogeography and climatic shifts in shaping early mammalian evolution. This model challenges previous assumptions of a simple dispersal corridor and instead proposes a complex scenario where only specific lineages succeeded in crossing into Australasia. Further exploration of Eastern Antarctica, where no fossil record has yet been discovered, will be key to testing and refining this model, potentially uncovering new insights into the biogeographic history of the southern continents.

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[Poster] [non-student]

New insights into the Late Jurassic mammal fauna of the Lourinhã Formation, Portugal: preliminary findings from recent excavations

Vicente D. Crespo[1,2,*], Thomas Martin[3], Alexander Guillaume[1,2] & Miguel Moreno-Azanza[1,4]

[1] Departamento de Ciências da Terra, FCT-UNL Faculdade de Ciências E Tecnologia, GeoBioTec, Universidade Nova de Lisboa, Caparica, Portugal;

[2] Museu da Lourinhã, Lourinhã, Portugal;

[3] Bonner Institut für Organismische Biologie, Abteilung Paläontologie, Universität Bonn, Bonn, Germany;

[4] Aragosaurus: Recursos Geológicos y Paleoambientes – IUCA, Departamento de Ciencias de la Tierra, Universidad de Zaragoza, Zaragoza, Spain;

[*] vidacres@gmail.com – presenting author

Keywords: Multituberculata, Dryolestida, Zatheria, cf. Morganucodonta, palaeoecosystem.

The Lourinhã Formation, located in western Portugal, is an Upper Jurassic sedimentary unit comprising fluvial, deltaic, and coastal deposits. The formation is especially notable for its vertebrate fossils, offering extensive insights into Late Jurassic ecosystems. It has important implications for palaeobiogeographic studies, linking European faunas with those from North America and North Africa at the end of the Jurassic period. Previous studies demonstrated that mammals constitute an important component of the Lourinhã Formation, notably by reporting seven species of multituberculates from the Porto das Barcas, Paimogo, and Porto Dinheiro sites. From the last site, besides one eutriconodontan triconodontid, one "symmetrodont", two dryolestids, and one zatherian were described.

We here report 17 new mammal teeth and one partial mandible with two teeth from the sites of Valmitão (Multituberculata indet. 1 and 2; Dryolestidae indet. 1 and 2; Zatheria indet.), Porto de Barcas (Multituberculata indet. sp. 3 and 4; Dryolestidae indet. 1), Zimbral (Dryolestidae indet. 1), and Peralta (Multituberculata indet. 3; Dryolestidae indet. 1), as well as two teeth of unknown origin (?Morganucodonta indet.; ?Dryolestidae indet. 3).

Of the four multituberculate taxa, three different sizes can be distinguished, with taxa 1 and 3 being similar in size, larger than 2 and 4. Morphologically, taxa 1 and 2 are more similar. Taxon 4 is very fragmentary and smaller than the rest. Each taxon is represented by different tooth positions. Up to three different taxa of Dryolestidae are present. The first is characterised by a fairly well developed talonid cusp and weakly developed main cusps. The second species is characterised by a better developed talonid cusp and an elongated paraconid. The third taxon is characterised by a much more developed paraconid, of the same width as the metaconid.

Regarding Zatheria, only a deciduous premolar was recovered. Finally, half a molariform tooth was found in which the arrangements of the cusps and cingulum are reminiscent of morganucodontans. If confirmed, this tooth would represent the first record of morganucodontans in the Late Jurassic of Portugal.

These newly discovered mammalian fossils support the significance of the Lourinhã Formation for the understanding of Late Jurassic paleoecosystems and biodiversity. They do not only provide valuable insights into mammalian diversity, but they also illustrate local differences to the slightly older Guimarota beds, and with the largely coeval Morrison Formation in the western USA.

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[Poster] [non-student]

New early-branching tetanuran (Dinosauria, Theropoda) remains from Iberia: the giant spinosaurid that roamed the Cameros Basin

Erik Isamendi[1], **Elena Cuesta**[2,*], Adrián Páramo[3,4] & Xabier Pereda-Suberbiola[1]

[1] Departamento de Geología/Geologia Saila, Facultad de Ciencia y Tecnología/Zientzia eta Teknologia Fakultatea, Universidad del País Vasco/Euskal Herriko Unibertsitatea, Leioa, Spain;

[2] SNSB - Bayerische Staatssammlungen für Paläontologie und Geologie München, Munich, Germany;

[3] Scientific Computation and Technological Innovation Center (SCoTIC). University of La Rioja, Logroño, Spain;

[4] Centro de Interpretación Paleontológica de La Rioja, Igea, Spain;

[*] elena.cuestaf@gmail.com – presenting author

Keywords: Lower Cretaceous, Dinosauria, Theropoda, Spinosauridae, Iberian Peninsula.

The palaeobiodiveristy of the Lower Cretaceous non-avian theropod fauna from the Iberian Peninsula is considerably high, including isolated teeth, fragmentary rest and some few complete specimen of spinosaurids, allosauroids, and coelurosaurs, including ornithomimosaurs. Among the different Mesozoic basins that have yielded theropod remains, the Cameros Basin has arisen as one of the most fossiliferous regions, leading to the discovery of different localities. This basin, located in northern Iberia, is part of the Iberian Basin Rift System. The theropod material from the Cameros Basin is mostly concentrated in the uppermost Barremian-lower Aptian lacustrine-palustrine deposits of the Enciso Group in the Eastern Cameros sub-basin (La Rioja, Spain). Until now, this record has been composed entirely of baryonychine spinosaurids, which contrasts with the great diversity of groups in other regions of the peninsula. However, the Western Cameros sub-basin has a scarcer theropod record, but more diverse, making this area of utmost importance for understanding the theropod palaeodiversity of the Cameros Basin and the entire Iberian Peninsula during the Early Cretaceous. Two localities from the Western Cameros sub-basin that have yielded a relevant

theropod record are the Los Caños and Zorralbo I fossil sites (Soria, Spain). These localities belong to the upper Hauterivian–lower Barremian fluvial deposits of the Golmayo Formation. The study carried out with these fossil remains has permitted the identification of three indeterminate tetanurans and three indeterminate baryonychine tooth morphotypes. In addition, cranial (lacrimal and prefrontal), axial, and appendicular elements belonging to the same individual were attributed to a large-sized member of Baryonychinae that differs from the already erected genera. It is the largest theropod individual recovered from the Lower Cretaceous strata of Iberia. These remains indicate that at least one non-spinosaurid tetanuran and a baryonychine spinosaurid coexisted in this formation. From these Western Cameros Basin discoveries, the Lower Cretaceous theropod from the Iberian Peninsula fauna has been consequently revised. The results strongly suggest that its non-avian theropod fauna is even more diverse than we previously thought. It would be represented by indeterminate tetanurans, spinosaurids, allosauroids, mid- to large-sized indeterminate coelurosaurs, such as ornithomimosaurs, and indeterminate paravians, such as dromaeosaurids. Among these clades, spinosaurids turned out to be the most diverse and abundant theropod group. The coincidence of the fossil records in the different Iberian basins suggests that many of these theropods inhabited and coexisted in them, and that these faunal assemblages may have been able to migrate among different basins.

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[Talk] [non-student]

Reevaluating the diversity and disparity of Transylvanian rhabdodontid (Ornithopoda) dinosaurs

Łukasz Czepiński[1,*], Felix J. Augustin[2], János Magyar[3,4], Dylan Bastiaans[5], Gábor Botfalvai[3,4], Daniel Madzia[1] & Zoltán Csiki-Sava[3,6]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[2] Department of Geosciences, University of Tübingen, Tübingen, Germany;

[3] Institute of Geography and Earth Sciences, Department of Palaeontology, ELTE Eötvös Loránd University, Budapest, Hungary;

[4] Department of Geology and Palaeontology, Hungarian National Museum Public Collection Centre, Budapest - Hungarian Natural History Museum, Budapest, Hungary;

[5] Natuurhistorisch Museum Maastricht, Maastricht, The Netherlands;

[6] Department of Geology, Mineralogy and Palaeontology, Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania;

[*] lczepinski@twarda.pan.pl – presenting author

Keywords: Europe, Cretaceous, Dinosauria, Ornithischia, Rhabdodontidae.

Rhabdodontidae represents a group of small- to medium-sized ornithischian dinosaurs endemic to the Late Cretaceous European Archipelago. Although rhabdodontids have traditionally been considered to exhibit a rather low diversity, recent discoveries suggest greater taxonomic richness, including the sympatric occurrence of multiple taxa likely facilitated by niche partitioning. Currently, three rhabdodontid species are recognised from Transylvania (Romania): *Zalmoxes robustus*, *Zalmoxes shqiperorum*, and the recently named *Transylvanosaurus platycephalus*.

To reevaluate the diversity of Transylvanian rhabdodontids, we conducted comprehensive morphological and morphometric studies of specific, and potentially diagnostic, cranial

elements (i.e. dentary and frontal bones), supplemented by a multivariate analysis of their character state distribution. Comparisons of the frontals indicate the presence of five distinct morphotypes, varying in their length-to-width ratio and in the configuration of the articulation with the nasal and prefrontal bones. Morphometric analyses of dentaries additionally showed that Transylvanian rhabdodontomorphs occupy a significantly broader morphospace than rhabdodontomorphs from other regions of Europe. Specimens previously recognized as *Zalmoxes robustus* and *Zalmoxes shqiperorum* plot into distinct morphospaces, while several dentaries lacking features that are diagnostic for either of these species are reconstructed as outliers to the *Zalmoxes* spp. morphospace.

Results of our analyses on both the dentary and frontal bones suggest that the diversity of rhabdodontid taxa from Romania is likely underestimated, and that some of the dentary and frontal specimens originally referred to *Zalmoxes* spp. may, in fact, not belong to this genus. Our observations highlight the need for a complex reevaluation of the rhabdodontid material from Transylvania in order to accurately recognize the true local taxic diversity of this group.

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[Talk] [non-student]

Three-dimensional reconstruction and visualization of Silurian fish fossils from Lithuania

Darja Dankina[1,*]

[1] Laboratory of Bedrock Geology, Nature Research Centre, Vilnius, Lithuania

[*] darja.dankina@gmail.com – presenting author

Keywords: tomography, synchrotron, Acanthodii, Thelodonti, Pridoli.

Micro-computed tomography (μCT) scanning is now a common way to look inside fossils without damaging them and to create detailed 3D models of their shapes inside and out. In this study, I report Late Silurian fish remains, including acanthodians and thelodonts, from the central and western parts of Lithuania. This material represents a previously unstudied assemblage discovered alongside Nijolė Sidaravičienė's ostracod collections stored at the Nature Research Centre in Vilnius, Lithuania. Taxonomic identification of the palaeoichthyofaunal remains indicates that most isolated scales and teeth belong to acanthodian species of *Nostolepis*, *Gomphonchoporus*, *Acanthodes*, *Fecundosquama*, and *Cheiracanthoides*. Meanwhile, thelodonts are represented only by *Loganellia grossi* in the revised boreholes' samples. Previously, in situ studies of the genera mentioned above were primarily discovered through histological analyses, which provided valuable insights into the structural composition of these fossils. However, such techniques are limited in their ability to fully capture the three-dimensional complexity of internal structures. The recent application of synchrotron-based tomographic imaging to newly scanned, revised samples, represents a significant advancement. This 3D imaging technique enables the comprehensive visualisation of the complete vascular system within the studied fish remains, providing a more detailed and accurate understanding of their morphology and development during the middle Paleozoic. Furthermore, the taxonomic studies contribute to expanding the palaeogeographical distribution of acanthodians and thelodonts across the Baltica palaeocontinent during Pridoli time. This work not only improves our understanding of primitive ichthyofaunal evolution during the Late Silurian but also advances the application of imaging techniques, offering new insights into the palaeoenvironmental conditions and palaeoecological niches of their inhabitants.

[Talk] [non-student]

Reassessment of *Spondylosoma absconditum* von Huene, 1942, an enigmatic archosaur from the Middle Triassic of South Brazil

Gustavo Darlim[1,2,*], Jonathas Bittencourt[3], Julio Marsola[4], Gabriel Ferreira[5,6] & Max Langer[7]

[1] GeoBio-Center, Ludwig-Maximilians-Universität München, Munich, Germany;
[2] Department of Earth and Environmental Sciences, Paleontology & Geobiology, Ludwig-Maximilians-Universität München, Munich, Germany;
[3] CPMTC, Departamento de Geologia, Instituto de Geociências, Universidade Federal de Minas Gerais;
[4] Federal University of Technology – Paraná, Dois Vizinhos, Paraná, Brazil;
[5] Senckenberg Centre for Human Evolution and Palaeoenvironment, Eberhard Karls Universität Tübingen, Tübingen, Germany;
[6] Fachbereich Geowissenschaften, Eberhard Karls Universität Tübingen, Tübingen, Germany;
[7] Laboratório de Paleontologia de Ribeirão Preto, FFCLRP, Universidade de São Paulo, Ribeirão Preto, Brazil;
[*] gustavo.darlim@gmail.com – presenting author

Keywords: Archosauria, Pan-Aves, Aphanosauria, Triassic, phylogeny.

Spondylosoma absconditum is a case, among many others, of historical burden in palaeontology. Described by von Huene in 1942 as a saurischian dinosaur based on a set of postcranial remains, *Spondylosoma absconditum* was found in the site known as Baum-Sanga (Excavation 44), during his famous expedition to south Brazil towards the end of the 1920s. The specimens found in "Excavation 44" are relatively scarce, originate from scattered parts of the skeleton, some are possibly duplicated (i.e., from individuals of likely different sizes), and thus offering a discrepant phylogenetic signal. After its original referral of *Spondylosoma absconditum* to Saurischia, its possible dinosaur affinity has been contemplated by many authors, as was also its position among pseudosuchians. More recently, it was proposed as being nested into a clade of non-ornithodiran pan-avians, i.e., Aphanosauria, which also includes other poorly understood Middle Triassic archosaurs such as *Dongusuchus efremovi* from Russia,

Teleocrater rhadinus from East Africa, and *Yarasuchus deccanensis* from India. However, detailed evaluation the anatomy of *Spondylosoma absconditum* and phylogenetic position in modern datasets remains to be explored. Here, we access the inclusiveness of the *Spondylosoma absconditum* hypodigm based on a multiproxy approach, taking taphonomy (their provenance) as a first parameter, followed by the exclusion of patently non-fitting bones (based on duplication or relative sizes). Based on first-hand analysis of the specimens, and use of micro computed tomography, we revise in detail the anatomy of *Spondylosoma absconditum* and furthermore investigated the phylogenetic affinities under maximum parsimony and Bayesian inference. A robust diagnosis was then elaborated, assigning and excluding the species from major lineages (Pan-Aves and Ornithodira, respectively) based on the presence/absence of synapomorphies identified in our phylogenetic analysis. Our parsimony analysis identified a likely phylogenetic position for the species (in early Pan-Aves), which is, however, rather unstable, as observed in a contrasting result of our Bayesian inference (*Spondylosoma absconditum* as an early aphanosaurian, although with low posterior probability, i.e., 0.3). This is clearly because of the large amount of missing data, but perhaps also for the conflicting signal given by misleadingly assigned skeletal parts. For the moment, if the attributed remains of *Spondylosoma absconditum* indeed belong to a single individual, they most likely represent a unique species, placed at the base of the panavian lineage. Further details, including its possible aphanosaur affinity, are, however, more prompt to debate.

[Talk] [non-student]

Palaeoparasitological potential of Permian–Triassic vertebrate coprolites

Kenneth De Baets[1,*], Paula Dentzien-Dias[2], Heitor Francischini[2], Weronika Łaska[1], Aleksandra Skawina[1] & Mateusz Tałanda[1]

[1] Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw, Poland;
[2] Departamento de Paleontologia e Estratigrafia, Instituto de Geociências, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil;
[*] k.de-baets@uw.edu.pl – presenting author

Keywords: Palaeoparasitology, coprology, parasite-host co-evolution, palaeoecology, vertebrate helminths.

It is estimated that about 40% of life on our planet are parasites, but it remains poorly understood how they respond to climatic changes and mass extinctions. The Permian–Triassic extinction, one of the largest biodiversity crises to be associated with climate-related stressors, offers a critical and unique case study to explore these dynamics. This loss of diversity must have affected the diversity of helminth parasites with fossilisable remains. Also, it is implied by inferred host switches in the phylogenies of modern lineages of helminths. Previous work shows the presence of tapeworms in Carboniferous-Permian coprolites, while the earliest reports of ascaridoid and oxyurid nematodes so far come from the Triassic, and have not been accompanied by any tapeworm remains. Previous palaeoparasitological studies focused on aquatic vertebrates in the Carboniferous–Permian time interval and on terrestrial tetrapods in the Triassic. This limits our understanding of diversity shifts within individual parasitic lineages as well as of extinction or host switching between those lineages.

Research on new material from Brazil and Poland shows the presence of at least three additional kinds of tapeworm remains in Permian fish coprolites from Brazil, but no remains of other helminth groups. Computed tomography of new specimens from the Triassic of Brazil and Poland indicates the similarity in preservation - with inclusions including bone remains - which have previously yielded helminth eggs and will help to assign these coprolites to their producers. Polish sites like Miedary, which have yielded hundreds of coprolites and with well-

known, associated vertebrate fauna, will be particularly crucial in this endeavour. The next steps are destructive analyses to constrain the presence of helminth remains in both fish and tetrapod coprolites in the Triassic. Further analysis of material from other Permian-Triassic localities as well as statistical modelling and including these remains in phylogenies are needed for co-phylogenetic estimates and our understanding of parasite extinction and host switching.

The primary working hypotheses we want to test is if parasites associated with Permian hosts (e.g., Paleozoic groups of sharks or gorgonopsid therapsids) disappeared with their hosts' extinction, while new Triassic parasites emerged alongside or switched to new vertebrate clades. Comparing similar environments before and after the extinction will help to constrain these extinctions, originations, and host switches.

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[Poster] [student]

Dynamics of fauna changes in the glacial and interglacial periods in central Poland

Kajetan Dedła[1,*] & Kamilla Pawłowska[1]

[1] Institute of Geology, Adam Mickiewicz University, Poznań, Poland;

[*] kajetandedla1@gmail.com– presenting author

Keywords: Woolly rhinoceros, woolly mammoth, Pleistocene, Poland.

With new finds of Pleistocene fauna remains in the central part of Poland (Wielkopolska region), our knowledge of them is gradually increasing. In order to observe a broader perspective of this dataset and emerging pattern, some works have been conducted by collecting faunal finds from various sites from Wielkopolska. In this work, we show so far collected data, which deal with diverse species of Pleistocene fauna in Wielkopolska, along with statistical input in its distribution in the area and time. The list of species includes, but is not limited to, the woolly mammoth (*Mammuthus primigenius*), woolly rhinoceros (*Coelodonta antiquitatis*), giant deer (*Megaloceros giganteus*), elk (*Alces alces*), roe deer (*Capreolus capreolus*), and cave lion (*Panthera spelaea*). This work contributes to a clearer picture of the dynamics of changes in the glacial and interglacial fauna from the Wielkopolska region.

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[Poster] [student]

Under pressure: functional adaptations of Mesozoic marine reptile skulls

Francesco Della Giustina[1,*] & Valentin Fischer[1]

[1] Evolution & Diversity Dynamics Lab, UR Geology, Université de Liège, Liège, Belgium;
[*] fdgiustina@uliege.be – presenting author

Keywords: Macroevolution, Mesozoic, marine reptiles, ecomorphology.

Numerous amniote lineages independently invaded the marine environments during the Mesozoic, including ichthyosaurians, plesiosaurians, mosasaurids, and marine crocodylomorphs. These groups evolved a range of craniodental morphologies that likely reflect distinct feeding strategies, prey specialisations, sensory capabilities, and hydrodynamic adaptations, enabling them to occupy high trophic levels within their ecosystems. Despite a growing interest in the evolutionary ecology of marine reptiles, large-scale quantitative assessments of their functional morphology across the entire Mesozoic remain relatively scarce, as most studies have focused on specific clades, time intervals, or anatomical regions (e.g., jaw shape, dentition).

Here, we present preliminary analyses of craniodental functional disparity throughout the entire history of Mesozoic marine reptiles, from the Triassic to the end of the Cretaceous. Our dataset comprises continuous and discrete morphological traits from over 450 taxa, making it the most extensive dataset of 2D and 3D craniodental data for Mesozoic marine reptiles to date, to our knowledge. Data was gathered from published sources, personal examination, and digital three-dimensional models. We used functionally relevant ratios to quantify disparity and track the evolution of key biomechanical traits across multiple temporal bins. To investigate potential adaptive pressures and peaks, we computed adaptive landscapes using the R package 'Morphoscape', focusing on traits related to feeding biomechanics (e.g., mechanical advantage), sensory capabilities (e.g., orbit size), and hydrodynamics (e.g., snout shape).

Preliminary results show that the Middle to Late Triassic was a moment of high functional disparity and ecological experimentation, while the Jurassic and Early Cretaceous are

characterised by relative functional stability, particularly among dominant groups such as parvipelvian ichthyosaurians, plesiosaurians, and thalattosuchian crocodylomorphs. During the Late Cretaceous, mosasaurids seem to adopt a different high-bite force optimal skull architecture compared to coeval and older plesiosaurians – a configuration previously only explored by a few metriorhynchoids. By combining ecomorphological analyses with adaptive landscape modelling, our approach helps reveal potential selective pressures and constraints that shaped the macroevolution of craniodental forms in Mesozoic marine reptiles.

[Poster] [non-student]

How should I publish my digital fossil? Recommendations for the publication of comprehensive 3D datasets in palaeontological studies

Verónica Díez Díaz[1,*], Matteo Belvedere[2], Marion Depraetere[1], Femke Holwerda[3], Isacco Alberti[2] & Daniela Schwarz[1]

[1] Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany;

[2] Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Florence, Italy;

[3] Utrecht University, Utrecht University Library, Utrecht, The Netherlands;

[*] diezdiaz.veronica@gmail.com – presenting author

Keywords: 3D model, data, metadata, FAIR Data Principles, palaeontology.

Data sharing is essential to scientific progress, and 3D models, along with their associated data and metadata, are no exception. Sharing fosters transparency, reproducibility and confidence in the scientific and publication processes, including peer-review, and it improves the global availability of scientific data. While it lies within the responsibility of the authors to generate, share, archive and manage their 3D data, scientific journals and repositories can facilitate the process of making 3D data accessible by providing clear guidelines and data policies. However, it is often not clear how a set of 3D data and associated metadata needs to be composed to be comprehensive and re-usable. The commonly used FAIR principles provide a good standard for such a comprehensive dataset, but are not specific towards the different 3D file types. Authors, journal editors, academic institutions, funding agencies and repositories play a key role in ensuring data adhere to FAIR Data Principles, which are essential for proper data management and stewardship, benefiting the academic community. Here, we show more standardised ways for researchers and scientific journals to make the 3D models of their research projects and the associated metadata accessible following FAIR Data Principles. To do so, we review the main points of the data cycle, and point out how data sharing benefits not only researchers, but the scientific community as a whole.

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[Poster] [non-student]

EAVP Women in Palaeontology Session 2025: The Matilda Effect. Diminishing authority and credibility of women in science

Verónica Díez Díaz[1,*], Elżbieta M. Teschner[2], Elena Cuesta[3] & Femke M. Holwerda[4]

[1] Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany;
[2] Institute of Biology, University of Opole, Opole, Poland;

[3] Bayersiche Staatssammlung für Paläontologie und Geologie, Munich, Germany;

[4] Earth Sciences, Utrecht University, Utrecht, The Netherlands;

[*] diezdiaz.veronica@gmail.com – presenting author

Keywords: Women in STEM, inequity, gender gap, academic bullying.

There are a multitude of factors why women in science are represented less than men. During our yearly Women in Palaeontology sessions at the European Association of Vertebrate Palaeontologists ("EAVP Women in Palaeo"), we have discussed many of these; e.g., harassment, academic bullying, mental load, caring, motherhood. Here, we address another factor that limits the success of women in Palaeontology and Science in general: the Matilda Effect. Named after suffragette Matilda Joslyn Gage, it describes the effect of diminishing women and their efforts in science by not properly crediting their work, ignoring their contributions, or even questioning their authoritative voice.

There are many examples of this in the history of women in science; (in)famously Rosalind Franklin who had a pivotal role in the discovery of DNA, yet history mostly remembers the two men Watson and Crick who wrote the paper and got the Nobel Prize (ironically recently another woman named Rosalind was skipped for the Nobel Prize in favour of her husband, leading to online and public outrage amongst women in STEM).

Closer to home, however, the organizers of the EAVP Women in Palaeontology roundtable this year will discuss their own personal experiences during the annual roundtable, and invite you, the audience to do the same. From exclusion from co-authorship, to open personal attacks under the guise of peer review, we have seen it all.

How to remedy this Matilda Effect and amplify Women in Science's voices and research? The role of mentors, role models and the visibility of our work in the media is important. Team Science should be encouraged, and most importantly, proper attribution for all players in a research effort, in order for nobody to be left out of the published peer reviewed work that is still the major academic currency of our time.

[Poster] [non-student]

Whose tracks are these? 3D reconstruction of the fossil turtle *Proganochelys quenstedtii* to estimate its locomotion – preliminary results

Dawid Dróżdż[1,*], Rafał Piechowski[2], Juned Zawira[3,] John R. Hutchinson[4] & Tomasz Szczygielski[2]

[1] Independent researcher, Warsaw, Poland;

[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[3] University of Lincoln, Lincoln, United Kingdom;

[4] Comparative Biomedical Sciences, Royal Veterinary College, London, United Kingdom;

[*] d.drozdz@interia.pl – presenting author

Keywords: Turtles, Triassic, biomechanics, limbs, muscles.

3D technologies are revolutionizing palaeontology by facilitating precise visualization of fossil material and conducting virtual experiments that were previously unfeasible. They are especially useful for computer simulations of movement in ancient animals, allowing quantitative testing of hypotheses. One such hypothesis is the assignment of the Mesozoic ichnogenus *Chelonipus* to early (stem) turtles. Here, we built the first 3D musculoskeletal model of the stem turtle *Proganochelys* (Late Triassic of Germany and Switzerland), one of the most basal testudinates and the most completely preserved Triassic turtle, to test its locomotor capabilities using a biomechanical model. Due to similarities in the attachment of the pelvis (not sutured to the shell), *Proganochelys*, as the model Triassic turtle, previously was assumed to have a similar mode of locomotion and range of movements as cryptodiran turtles, allowing it to produce trackways of similar characteristics, and thus a viable candidate for the trackmaker of *Chelonipus*. However, numerous differences regarding the pectoral girdle, appendicular bones, and, presumably, the muscular system were thus far ignored and the locomotion of the earliest turtles was never rigorously tested. Moreover, new data show that the distribution of *Proganochelys* was limited compared to *Chelonipus* and that another clade, i.e., the Proterochersidae, was much more widespread. The latter turtle group had the pelvis co-ossified

with the shell, rendering their locomotion potentially more comparable with pleurodires. Finally, *Chelonipus* is problematic because it appears long before known representatives of the lineage evolved the shell. We digitized bones of *Proganochelys* using surface scanning and photogrammetry. The skeleton was virtually assembled, creating a virtual 'marionette' with an established workflow. Musculature was also reconstructed based on osteological correlates and phylogenetic bracketing. The next step will involve reconstructing the 3D musculature in the model, followed by simulations of potential locomotor patterns. The resulting data will be compared with data from extant turtles and other shelled tetrapods, along with the ichnological record to evaluate their congruence with *Chelonipus* trackways.

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[Poster] [non-student]

The Triassic turtle of Thailand – revision of '*Proganochelys*' *ruchae*

Dawid Dróżdż[1,*], Tomasz Szczygielski[2], Phornphen Chanthasit[3], Sita Manitkoon[4,5] & Pitaksit Ditbanjong[6]

[1] Independent researcher, Warsaw, Poland;
[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[3] Department of Mineral Resources, Sirindhorn Museum, Kalasin, Thailand;
[4] Palaeontological Research and Education Centre, Mahasarakham University, Maha Sarakham, Thailand;
[5] Vertebrate Palaeontology and Evolution Research Unit, Excellence Center in Basin Studies and Applied Palaeontology, Mahasarakham University, Kham Riang, Thailand;
[6] Department of Geotechnology, Faculty of Technology, Khon Kaen University, Khon Kaen, Thailand;
[*] d.drozdz@interia.pl – presenting author

Keywords: Turtles, Triassic, Thailand, *Proterochersis*, collections.

True turtles (Testudinata) appeared in the Norian (Late Triassic) and quickly attained a worldwide distribution and relatively high diversity. Their remains are currently known from that time from Asia, Europe, North America, and South America, and represent at least three separate clades. Whereas the generic and suprageneric attribution of comparatively well-preserved and studied European and South American taxa, such as *Proganochelys quenstedtii*, *Proterochersis robusta*, *Proterochersis porebensis*, *Palaeochersis talampayensis*, and *Waluchelys cavitesta* sparks no controversy, the more fragmentary and less common species have been variably considered representatives of separate genera or referred to already existing ones – most commonly, *Proganochelys*. This uncertainty is unfortunate, as it severely muddles the picture of the evolution, diversity, and geographic distribution of the earliest turtles. One such problematic species, originating from the Norian Huai Hin Lat Formation of Thailand, was described in 1980s as *Proganochelys ruchae*. However, this generic attribution was subsequently put into question and the recent increase of available Triassic turtle material

allows to transfer that species from *Proganochelys* to its own new genus, *Thaichelys*, and place it in the clade of *Proterochersidae*, together with *Proterochersis* spp., *Keuperotesta limendorsa*, and *Chinlechelys tenertesta*. As a result, the genus *Proganochelys* is considered here to be solely a central Pangaean (modern-day European) taxon. Moreover, *Thaichelys ruchae* exhibits in some respects a transitional morphology between other Triassic taxa and *Proterochersis* spp., and may constitute a sister taxon to the grouping of *Proterochersis* spp. and *Keuperotesta limendorsa* from Europe. This, in turn, considering the lack of a Carnian record of pantestudinates outside of Asia, suggests that *Thaichelys ruchae* could represent an early radiation of the *Proterochersidae* which branched off before the *Testudinata* dispersed into the western Pangaea.

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[Talk] [non-student]

Saurodesmus robertsoni Seeley, 1891 - the oldest Scottish cynodont (Synapsida, Therapsida)

Tomasz Szczygielski[1], Marc Johan Van den Brandt[2], Leandro Gaetano[2,3] & **Dawid Dróżdż**[4,*]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[2] Evolutionary Studies Institute (ESI), University of the Witwatersrand, Johannesburg, South Africa;

[3] Instituto de Estudios Andinos "Don Pablo Groeber" (IDEAN, UBA-CONICET), Ciudad Autónoma de Buenos Aires, Buenos Aires, Argentina;

[4] independent researcher, Warsaw, Poland;

[*] d.drozdz@interia.pl – presenting author

Keywords: Cynodontia, femur, Late Triassic, Scotland, turtle.

Predating Darwin's theory of evolution, the holotype of *Saurodesmus robertsoni* is a long-standing enigma. Found at the beginning of 1840s, the specimen is a damaged stylopodial bone over decades variably assigned to turtles, archosaurs, parareptiles, or synapsids, and currently nearly forgotten. We redescribe and re-assess that curious specimen as a femur and consider *Saurodesmus robertsoni* as a valid taxon of a derived cynodont (?Tritylodontidae). It shares with probainognathians more derived than *Prozostrodon* a mainly medially oriented lesser trochanter and with the clade reuniting tritylodontids, brasilodontids, and mammaliaforms (but excluding tritheledontids) the presence of a projected femoral head, offset from the long axis of the femoral shaft; a thin, plate-like greater trochanter; a distinct dorsal eminence proximal to the medial (tibial) condyle located close to the level of the long axis of the femoral shaft and almost in the middle of the width of the distal expansion; and a pocket-like fossa proximally to the medial (tibial) condyle. *Saurodesmus robertsoni* is most similar to tritylodontids, sharing at least with some forms: the relative mediolateral expansion of the

proximal and distal regions of the femur, the general shape and development of the greater trochanter, the presence of a faint intertrochanteric crest separating the shallow intertrochanteric and adductor fossae, and the general outline of the distal region as observed dorsally and distally. This makes *Saurodesmus robertsoni* the first Triassic cynodont from Scotland and, possibly, one of the earliest representatives of tritylodontids and one of the latest non-mammaliaform cynodonts worldwide. Moreover, it highlights the need for revisiting historical problematic specimens, the identification of which could have been previously hampered by the lack of adequate comparative materials in the past.

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[Talk] [non-student]

New data on the Early Badenian (Middle Miocene) bony fishes of the Forecarpathian Basin

Anastasiia Dubikovska[1,2,*], Marcin Górka[3], Mykola Skyrpan[4], Malgorzata Bienkowska-Wasiluk[3], Zoltán Barkaszi[5,6] & Oleksandr Kovalchuk[1,5,7]

[1] Department of Biology and Biology Teaching Methodology, Faculty of Natural Sciences and Geography, A. S. Makarenko Sumy State Pedagogical University, Sumy, Ukraine;

[2] Schmalhausen Institute of Zoology, National Academy of Sciences of Ukraine, Kyiv, Ukraine;

[3] Department of Sedimentary Basins, Faculty of Geology, University of Warsaw, Warsaw, Poland;

[4] Independent researcher, Lviv, Ukraine;

[5] Department of Palaeontology, National Museum of Natural History, National Academy of Sciences of Ukraine, Kyiv, Ukraine;

[6] Department of Agricultural Sciences, John von Neumann University, Kecskemét, Hungary;

[7] Department of Palaeozoology, Faculty of Biological Sciences, University of Wrocław, Wrocław, Poland;

[*] oakovska@email.com – presenting author

Keywords: Actinopterygians, assemblage, diversity, Miocene, Ukraine.

During the Middle Miocene, the shallow marine environment of the Forecarpathian Basin, which was part of the Central Paratethys, harboured a diverse fish fauna. A series of fish fossils represented by 530 specimens of dental elements was recovered from the Lower Badenian deposits of the Mykolaiv Beds in western Ukraine. Sixteen taxa have been identified that belong to the families Sphyraenidae, Trichiuridae, Labridae, Acanthuridae, Sparidae, Tetraodontidae, and Diodontidae. Due to the quality of the material, only six taxa have been identified to species: *Labrodon pavimentatum*, *Trigonodon jugleri*, *Acanthurus haueri*, *Diplodus*

jomnitanus, *Diplodus sitifensis*, and *Sparus umbonatus*. Most of the revealed taxa were common representatives of the Middle Miocene fish fauna of the Central Paratethys. *Acanthurus haueri* as well as Tetraodontiformes indet., *Oligodiodon* sp., Diodontidae gen. et sp. indet. and the orders they represent (Acanthuriformes and Tetraodontiformes) are recorded for the first time in the Forecarpathian Basin. Most of the identified specimens belong to sea breams (83.6%), followed by porcupinefishes (8.7%), barracudas (4.2%), and wrasses (2.3%), which are all predatory fishes occupying different trophic niches within the marine environment.

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[Poster] [non-student]

An exotic snake fauna from a Paleogene locality in Serbia

Dragana D. Đurić[1,*]

[1] Natural History Museum, Belgrade, Serbia

[*] dragana.djuric@nhmbeo.rs – presenting author

Keywords: Paleogene, Booidea, *Falseryx*, Balkan Peninsula.

A new snake find renders the rather poorly known fossil snake fauna from Serbia richer. Deposits of fossil vertebrates from the fluvio-lacustrine of southeast Serbia were discovered. The site is situated next to an abandoned coal mine east of the Valniš village, about 15 km south of Babušnica. The fossils come from a clayey sediment rich in coal. The material is dominated by small mammals, however, a significant number of snake vertebrae were also recovered. The estimated age of the rodent association based on biostratigraphic data pertains to the late Eocene–early Oligocene. At first glance, it was noticeable that the remains of snakes belonged to taxa that have not been identified in the Serbian fossil record. Representatives of Booidea and Alethinophidia incertae sedis were identified. The best-preserved vertebrae are most similar to cf. *Bavarioboa* sp. and cf. *Falseryx* sp. Large parts of the available vertebrae are more or less damaged and partially deformed, which makes identification difficult. This material requires careful processing in the future because it represents the first Paleogene fauna of snakes found in Serbia and one of the very few of that age known from the Balkans as whole.

[Poster] [non-student]

The changing nature of dinosaurs

Kristina Eck[1,*], Nina Schaller[1] & Rikk Villa[1]

[1] Klaus Tschira Foundation Heidelberg;

[*] kristina.eck@tschira-jugendakademie.info – presenting author

Keywords: dinosaurs, education, science.

Few scientific disciplines inspire public interest to the same degree as palaeontology. Our natural fascination with dinosaurs and ancient humans is an enduring phenomenon, but the underlying principles that guide scientific work remain a mystery to most people.

Scientists must acknowledge that "truth" exists within a historical framework; as new technologies and techniques emerge, theories and discoveries evolve to refine the knowledge base, sometimes rendering previously accepted "facts" obsolete. This may contribute to public skepticism.

The exact truth regarding evolutionary and geological events, especially in prehistoric realms, is elusive. Dinosaurs provide ample evidence of serial misinterpretation of "facts" as our understanding of these iconic animals radically expanded over time. This accessible example provides an opportunity to demonstrate the cycle of knowledge acquisition – a process in which the latest scientific findings discredit old theories, resolve puzzling questions and, inevitably, raise new ones.

The programs of the Tschira Youth Academy are conceived and presented by doctoral scientists who moved beyond research into science communication to inspire interest in the natural world and promote a greater understanding of scientific inquiry. Our research courses, workshops, and continuing education programs encourage motivated students and teachers to explore our increasingly complex world through experiential learning, multidisciplinary experimentation and direct contact with experts in their field.

[Talk] [student]

AI and citizen science data help accelerate high quality fossil identifications by experts

Isaak Eijkelboom[1,2,*], Laurens Hogeweg[1], Django Brunink[1], Anne S. Schulp[1,2] & Frank P. Wesselingh[1,2,3]

[1] Naturalis Biodiversity Center, Leiden, the Netherlands;

[2] Department of Earth Sciences, Utrecht University, Utrecht, the Netherlands;

[3] Faculty of Science and Engineering, Maastricht University, Maastricht, the Netherlands;

[*] isaak.eijkelboom@naturalis.nl – presenting author

Keywords: Machine learning, citizen science, data quality, Quaternary, North Sea Basin.

Accurate identification of fossils is instrumental to palaeontological research but requires expert knowledge, is time consuming, and is subject to human biases. Through citizen science platforms and apps, AI-assisted identifications can mitigate those challenges, as shown e.g., in successful biodiversity research applications. Fossil data is relatively scarce, but large and growing fossil datasets are made available in open data repositories through collection digitisation efforts. Furthermore, data is collected and validated by fossil enthusiasts on citizen science platforms. These datasets can be used as training data for deep learning classification models to provide both experts and citizen scientists with accurate, quick and easy to use tools to collect, validate and analyse palaeontological data. However, AI-model performance may be limited by the size and quality of the training dataset. We present and compare a set of convolutional neural networks (CNNs) that are trained and tested on standardised images from museum and private collections (>46,000 images) and images from the online citizen science platform Oervondstchecker.nl (>74,000 images). Both datasets consist of Quaternary vertebrate fossils and artefacts from the Netherlands and the southern North Sea Basin. Moreover, we compare model performance with identifications by 10 domain experts and active citizen scientists to gain a measure of data quality. The CNNs perform best when trained on standardised images (~85% top-1 accuracy) compared to citizen science data (~65% top-1

accuracy). Identifications by fossil experts show variable agreement among these experts. Based on these insights we make recommendations on how to account for variable validator input to optimise AI model training and performance. The synergy between AI model predictions and domain expert identifications can rapidly increase the amount of high-quality identifications of fossils and flag potential rare finds. Finally, to further increase data acquisition and public engagement, the models with the best overall performance have been made publicly available online (https://museum.identify.biodiversityanalysis.nl/model/beach_fossils_species) for use by professional experts, citizen scientists and the general public alike.

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[Talk] [student]

Late Miocene viverrids (Carnivora) from Italy: new species and the first record of *Civettictis* in Eurasia

Andrea Faggi[1,*] & Saverio Bartolini Lucenti[1]

[1] Earth Science Department, University of Florence, via La Pira 4, 50121 Florence, Italy;
[*] andrea.faggi@unifi.it – presenting author

Keywords: Taxonomy, Viverridae, Miocene, Neogene.

The Italian fossil record of Viverridae, a family of small to medium-sized carnivores including civets and genets, is extremely scarce, with most discoveries limited to a few localities in Tuscany and Piedmont from the Late Miocene and Pliocene. In this study, we present the description of two new viverrid species based on material from the Late Miocene (MN 12–13) locality of Gravitelli (Sicily) and the latest Miocene (5.41–5.33 Ma) sites of Monticino Quarry (Emilia-Romagna) and Moncucco (Piedmont). The Gravitelli specimens, originally attributed by Seguenza to the small hyaenid *Plioviverrops orbignyi*, have been re-evaluated through detailed morphological and morphometric comparisons. The dental morphology, particularly of the lower carnassials, is incompatible with that of any insectivorous or omnivorous hyaenid, but with features suggesting affinities to the extinct viverrid *Semigenetta.* Although closely related to species of the latter, the Gravitelli material differs sufficiently from known species to support the erection of a new taxon, representing the last known occurrence of *Semigenetta* in the fossil record. Due to the destruction of the original material in the 1908 Messina earthquake, this reassessment is based on early 20th-century descriptions and figures. The Moncucco locality provides the richest assemblage of viverrid fossils known from Italy. Morphological and metric analyses show strong similarities to African taxa such as *Sahelictis korei*, *Civettictis vulpidens*, and *Civettictis leakeyi*. In particular, *Civettictis vulpidens* shares several key dental traits with the Moncucco specimens, including a circular upper canine cross-section, the absence of mesial and distal accessory cusps on P3, and a relatively elongated P4 metastyle. However, the Moncucco specimens are characterized by smaller size and proportions more similar to those of modern *Civettictis civetta*. Together with the material from Monticino Quarry, the Moncucco remains are assigned to a new species of *Civettictis*, representing the first occurrence of this genus in Eurasia. These findings provide new insights into the evolutionary history, diversity, and dispersal patterns of viverrids in the Mediterranean during the Late Miocene.

[Talk] [non-student]

Expanding the osteohistological toolbox for palaeophysiological studies

Mathieu G. Faure-Brac[1,*] & Lene L. Delsett[1]

[1] Naturhistorisk Museum, Universitetet i Oslo, Norsk Center for Paleontologie, Oslo, Norway;
[*] m.g.f.brac@nmh.uio.no – presenting author

Keywords: Osteohistology, palaeophysiology, phylogenetic comparative methods, quantitative analysis.

One way to study the thermophysiology of extinct organisms is to infer 2D measurements of the red blood cells, namely their width and area, by using histological data from femora and incorporating this into physiological models. However, this method suffers of one major issue: the model is based on femoral sections, and this bone is known to be reduced or even missing in several groups of amniotes, especially marine ones, limiting its usefulness. Moreover, recent studies questioned the use of size and area in erythrocytes and proposed to use the mean corpuscular volume (MCV) instead, which would also significantly expand the available data. In order to incorporate MCV in our studies, we 1) tested if a significant correlation exist between the harmonic mean of vascular canals (HMC) and MCV and 2) tested if there is a significant difference between HMC from femur and humerus in order to use humeral data when femoral ones are missing. Our results demonstrate a significant correlation between HMC and MCV and the absence of a significant difference in the inferences using the two different bones. This supports the modification of our current model towards the use of MCV as the response variable and the incorporation of humeral data, greatly expanding the available data for many animal groups.

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[Poster] [student]

Pterosaur teeth from the Jurassic Morrison Formation of Wyoming, USA

Alexandra E. Fernandes[1,*]

[1] American Museum of Natural History, New York, New York, USA;

[*] afernandes@amnh.org – presenting author

Keywords: Pterosauria, Morrison Formation, Jurassic, Wyoming.

Pterosaurs flourished throughout the Mesozoic, diversifying extensively during this time range (and especially towards the Late Jurassic and into the Cretaceous), eventually reaching a worldwide distribution. This variety allowed for a vast array of morphological adaptations, with great variability being reflected throughout their bodies, including their dentition. Despite this overall abundance and diversity, however, the Morrison Formation reflects a relatively poor preservation record for pterosaurs (especially when compared to other fossil vertebrates), with remarkably few fossils recovered. Here we describe two pterosaur teeth recently recovered from the Morrison Formation of Wyoming, USA (Upper Jurassic), which are evaluated on several dental characteristics, including: shape, dimension, curvature of their crowns and apices, degree of labiolingual compression, position of the enamel-dentine-boundary (EDB), enamel ornamentation, shape of the cross-sections, and size of the pulp cavity. Their overall morphologies and dental features reveal two distinct taxa with different ecomorphotypes, representative of each group's particular feeding strategies, and supporting different attributions: one to the Ctenochasmatidae and one to the Rhamphorhynchidae. These attributions are congruent with previous pterosaur records from the Morrison Fm, emphasizing the presence of these taxa, despite few fossil remains. Their recovery also illustrates the diversity of the feeding behaviors exhibited by pterosaurs during the Late Jurassic, contributing additional palaeoecological niche elements towards reconstructing the crucial palaeoenvironmental role doubtlessly played by the Pterosauria during this time period, and throughout the Mesozoic.

[Talk] [student]

The development of the frontal sinus in fossil sabertoothed cats (Carnivora, Felidae): possible morphological and ecological inferences

Samuele Frosali[1,*], Joan Madurell-Malapeira[1], Nikolai Spassov[2], Denis Geraads[3], Francisco J. Prevosti[4], Alberto Boscaini[5], Saverio Bartolini Lucenti[1] & Lorenzo Rook[1]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;

[2] Department of Palaeontology and Mineralogy, National Museum of Natural History Sofia, Bulgaria;

[3] CR2P, Muséum National d'Histoire Naturelle, CNRS, Sorbonne Université, Paris, France;

[4] Museo de Ciencias Antropológicas y Naturales Universidad Nacional de La Rioja (UNLaR), La Rioja, Argentina;

[5] Instituto de Ecología, Genética y Evolución de Buenos Aires (IEGEBA), Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina;

[*] samuele.frosali@edu.unifi.it – presenting author

Keywords: Skull, Mammalia, virtual palaeontology, thermoregulation.

We analyse the morphology and morphometry of the frontal sinuses of various fossil species of sabertoothed cats (Machairodontinae). This paranasal cavity represents a poorly studied endocranial cavity, one not clearly defined on a morphological or even functional point of view in carnivorans (with a few exceptions; e.g., Hyaenidae). In other carnivorans the most widely accepted hypothesis to explain the function of this structure is the dispersion of stresses during feeding, with the harder the food eaten, the bigger the development of the frontal sinus. Given the fact that felids are all hypercarnivorous species, the different development of the frontal sinus might be linked to other specific adaptations, for example brain cooling in more cursorial and sprinter species like *Acinonyx jubatus*.

This analysis, based on non-invasive imaging, represents one of the first explorative studies on the variation of the development and morphology of this structure within the Felidae. We highlight how the different species of sabertoothed cats here analysed show widely different developments and morphologies of this paranasal cavity. This suggests that these extinct species had different ecological niches, with specific adaptations to different life-styles. The analysis highlights that *Yoshi garevskii* presents the most developed frontal sinus out of all the species here analysed (both extant and extinct). This highly developed paranasal cavity is plausibly linked to brain cooling, like we see in the extant cheetah, thus corroborating the already hypothesised idea of a high cursoriality in this fossil sabertoothed cat species.

[Talk] [non-student]

Eocene, the "Golden Era" of snakes in Europe

Georgios L. Georgalis[1,*]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[*] georgalis@isez.pan.krakow.pl – presenting author

Keywords: Serpentes, Squamata, taxonomy, biogeography.

The Eocene Epoch (56 to 33.9 million years ago) witnessed an unprecedented taxonomic diversity of snakes in Europe. Fossil record attests for a plethora of shapes, sizes, ecological strategies, functional morphologies, and unique skeletal features. Eocene snakes in Europe ranged from tiny scolecophidians to large constrictors and truly gigantic palaeophiids. Their high taxonomic diversity is aptly attested by the fact that, so far, as many as 49 extinct species and 30 extinct genera have been established upon fossil material from the European Eocene. These pertained to early members of extant groups, such as pythonoids and booids, but also a fascinating (but also enigmatic) parade of unique, bizarre, and now extinct clades, such as palaeophiids, russellophiids, and anomalophiids. Their fossil record primarily consists of isolated vertebrae; nevertheless, cranial remains are also known, while (more rarely) also complete articulated skeletons and even mummified portions of snake bodies have been found. Particularly for the complete skeletons from the few Eocene Fossillagerstätte localities in Messel, Geiseltal, and Monte Bolca, these have offered substantially valuable insights into the cranial anatomy and intracolumnar variation of multiple extinct snake taxa, as well as aspects of their palaeoecology. Moreover, being ectothermic vertebrates, fossil snakes provide important information on the major climatic events and faunal turnovers that occurred during the Eocene, such as the Paleocene–Eocene Thermal Maximum (PETM), the Early Eocene Climatic Optimum (EECO), and the "Grande Coupure" at the Eocene–Oligocene boundary. Nevertheless, important questions remain unanswered, substantially hindering our

understanding of European snake evolution; as a matter of fact, many named snake taxa have not been adequately described since their original establishment in the 19th century, while the phylogenetic relationships of various taxa are clouded by mystery. Novel technologies, such as micro-computed tomography (μCT) scanning, coupled with an advanced knowledge of the skeletal anatomy of extant taxa, are now offering new, powerful tools for properly assessing the taxonomic diversity and anatomy of Eocene snakes from Europe. An ongoing redescription of the type specimens of Eocene named species, coupled with the documentation of abundant new fossil specimens (both cranial and vertebral elements) from multiple localities across Europe, offer the potential for augmenting the known diversity of Eocene snakes and deciphering important aspects of their anatomy, taxonomy, origins, and biogeography.

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[Poster] [non-student]

A large ungaliophiid snake (Serpentes, Booidea) from the Eocene Fossillagerstätte of Geiseltal, Germany

Georgios L. Georgalis[1,*], Krister T. Smith[2,3], Kacper Węgrzyn[1], Oliver Wings[4,5], Márton Rabi[5,6], Roberto Rozzi[5,7], Bastien Mennecart[8] & Alessandro Palci[9]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;
[2] Department of Messel Research and Mammalogy, Senckenberg Research Institute, Frankfurt am Main, Germany;
[3] Faculty of Biosciences, Goethe University, Frankfurt am Main, Germany;
[4] SNSB, Natural History Museum Bamberg, Bamberg, Germany;
[5] Natural Sciences Collections, Martin Luther University Halle-Wittenberg, Halle (Saale), Germany;
[6] Department of Geosciences, Eberhard Karls Universität Tübingen, Tübingen, Germany;
[7] Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[8] Naturhistorisches Museum Basel, Basel, Switzerland;
[9] College of Science and Engineering, Flinders University, Adelaide, South Australia, Australia;
[*] georgalis@isez.pan.krakow.pl – presenting author

Keywords: Squamata, Serpentes, Constrictores, taxonomy, μCT scanning.

Ungaliophiidae represents a small group of snakes that comprises solely two extant genera, *Exiliboa* and *Ungaliophis*, with three species in total. These snakes were for a long time included in an expanded taxonomic concept of Tropidophiidae, however, recent studies have recovered them as members of Booidea, probably related to the North American charinaids. Ungaliophiids are currently confined geographically, being distributed solely in continental Central and northern South America. Nevertheless, the fossil record attests for a much wider geographic distribution, particularly during the Eocene, when the group was also present in North America and Europe. In the latter continent, the genera *Messelophis* and *Rieppelophis*,

both known from beautifully articulated skeletons with skulls from the Fossillagerstätte of Messel (Germany), have been considered phylogenetically close to Ungaliophiidae and are possibly in-group or stem-group members of this family/clade and the vertebra-based taxon *Dunnophis* from the middle and late Eocene of France could also pertain to this group. We here describe a snake skeleton with skull (GMH XXXVIII-67-1964) housed in the Geiseltal collection of the Martin Luther University Halle-Wittenberg, originating from the late early to early middle Eocene Fossillagerstätte of Geiseltal (Germany). With the aid of μCT scanning, we thoroughly investigated its cranial and postcranial anatomy. Our detailed comparisons suggest affinities of this fossil specimen with Ungaliophiidae, and a close resemblance to *Messelophis*. Nevertheless, there are important differences between the skeleton GMH XXXVIII-67-1964 and the known extant and extinct ungaliophiids, especially with regard to the morphology of its skull (particularly the shape of the frontals, parietal, supratemporal, and dentary) and certain vertebral structures. One interesting feature of the Geiseltal skeleton is its relatively large size: the available preserved length of the skull (22.9 mm from the tip of the frontals to the posterior edge of otooccipitals) is much larger than that of any other known ungaliophiid, either extinct or extant. Moreover, its preserved total length exceeding 109 cm, also ranks it as larger than any other ungaliophiid. Our new find demonstrates that large ungaliophiids were present back in the Eocene of Europe, and also suggests that this group of booids could have evolved miniaturization during the Eocene while some larger lineages still persisted, however more finds are necessary in order to test this evolutionary hypothesis.

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[Talk] [student]

A quantitative comparison of the large theropod tracks from the French and Swiss Late Jurassic carbonate Jura platform

Vincenzo Gesualdi[1,*], Lara Sciscio[2,3], Emmanuel Fara[4], Christian Meyer[5,6], Jean-David Moreau[7,4], Alessandro Riga[8] & Matteo Belvedere[1]

[1] Dipartimento di Scienze della Terra, Università degli Studi di Firenze, Firenze, Italy;
[2] JURASSICA Museum, Porrentruy, Switzerland;
[3] Department of Geosciences, University of Fribourg, Fribourg, Switzerland;
[4] Université Bourgogne Europe, CNRS, Biogéosciences, Dijon, France;
[5] Department of Environmental Sciences, University of Basel, Basel, Switzerland;
[6] Museo de Historia Natural Alcide d'Orbigny, Cochabamba, Bolivia;
[7] Université Paris-Saclay, CNRS, Orsay, France
[8] Dipartimento di Biologia, Università degli Studi di Firenze, Italy;
[*] vincenzo.gesualdi@unifi.it – presenting author

Keywords: *Megalosauripus transjuranicus*, computational ichnology, geometric morphometrics, Late Jurassic.

The presence of large theropod tracks in Europe during the Late Jurassic is known from numerous tracksites (e.g., Spain, Portugal). The Jura carbonate platform is a key area in Europe for the study of Late Jurassic dinosaur ichnology. During the cyclic platform emersions, the landmasses of the Massif Central and Rhenish Massif were connected allowing terrestrial vertebrates to move through. The Kimmeridgian microbial laminites of the Swiss Jura tracksites (western Switzerland), recently yielding a megatracksite, are exceptional in terms of track quantity and anatomical fidelity of the preservation. Notably, this is the type locality of the theropod ichnotaxa *Megalosauripus transjuranicus* and *Jurabrontes curtedulensis*. A similar situation is found at the Tithonian tracksite of Plagne in the French Jura (eastern France). This site exhibits, across two primary track-bearing levels, both the longest European sauropod trackway (which is now partially covered for conservation purposes) and a large-sized theropod trackway. This theropod trackway is qualitatively comparable to *M. transjuranicus*, although

the footprints are smaller in size (French average FL: 31.65 cm; Swiss average FL: 42.5 cm). Quantitative comparisons of the French and Swiss tracks were carried out using Geometric Morphometrics and "whole track" analyses. These analyses provide additional evidence to support the attribution of the Plagne theropod tracks to this ichnotaxon. This confirm *Megalosauripus transjuranicus* as a pan-European ichnotaxon in the Late Jurassic, while expanding its temporal range up to the Tithonian.

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[Talk] [non-student]

Azhdarchid pterosaur tracks from the Upper Cretaceous of Poland and Morocco

Gerard Gierliński[1,*]

[1] JuraPark, Bałtów, Poland;

[*] gierlinski@yahoo.com – presenting author

Keywords: Ichnology, Late Cretaceous, *Haenamichnus*.

A large tetradactyl track from the Campanian of Roztocze Hills in Poland was formerly labelled as *Macropodosaurus* by the author in 2009. This was the second find of *Macropodosaurus* after its original description from the Albian of Tadzhikistan. Since 2009, *Macropodosaurus*-like tracks referred to therizinosaurs were reported from Utah (USA), Morocco and Korea. However, this recently rich *Macropodosaurus* material shows morphological incompatibility. The footprints from Poland and Morocco are paraxonic with the clear space between digits and the bear-like shaped metapodium with subtriangular heel. Digits are relatively short and narrow parallelly arranged. In contrast, tracks from Tadzhikistan, Utah and Korea comprises more theropod-like mesaxonic tracks with subrectangular heel and relatively long digits integrated with metapodium.

The discussed footprints from Poland and Morocco resemble morphology exhibited by *Haenamichnus gainensis* from the Albian of Korea and interpreted as the bipedal azhdarchid tracks. The coincidence correlation also supports azhdarchid affinity of the Polish and Moroccan specimens because of the azhdarchid presence versus therizinosaur absence in the Cretaceous of Europe and Africa.

[Poster] [student]

Moving tails: calculating the Ranges of Motion (RoM) of the caudal series of Late Jurassic sauropods from Tendaguru (Tanzania)

Alessandro Gigliotti[1,2,*], Florian Schäfer[1,2], John A. Nyakatura[2] & Verónica Díez Díaz[1]

[1] Museum für Naturkunde Berlin - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany;

[2] Humboldt Universität zu Berlin, Berlin, Germany;

[*] alessandro.gigliotti@mfn.berlin – presenting author

Keywords: Sauropoda, Range of Motion, biomechanics, Tendaguru, caudal series.

In this project, the Ranges of Motion (RoM) of the caudal series of two Late Jurassic sauropod dinosaurs from Tendaguru of Tanzania, *Wamweracaudia keranjei* and *Dicraeosaurus hansemanni,* are examined. The 3D models of the caudal vertebrae were assembled in Osteological Neutral Pose (ONP) of the caudal series, using sub-parallel centra and zygapophyseal contact faces as proxies. To account for unknown intervertebral cartilage thickness in fossil taxa, the ONPs were adjusted to three different Cartilaginous Neutral Poses (CNPs), adding different values to the distance between two vertebrae. Different locations for the Centre of Rotation (CoR) depending on the type of articulation have been tested, to assess if the CoR placement also plays an important role for the calculation of maximum RoMs. The different Ranges of Motion (maximum dorsiflexion and ventroflexion, lateral flexion, and torsion) are calculated by moving the vertebrae in three degrees of freedom based on each CoR until an osteological limit appears or the zygapophyseal contact is lost.

The two studied sauropod species present caudal series with features that clearly differentiate them mainly in the type of articulation and the morphology and orientation of the neural spines. The *Dicraeosaurus* tail shows a strong downward curving in the anterior part of the tail that lines up with elongation of the neural spines and exhibits mainly amphiplatyan and amphicoelous articulations compared to the strong procoely present in the anterior region of the straighter-oriented *Wamweracaudia* tail.

The results of this study provide insights into the different intra- and interspecific behaviour of giant sauropod dinosaurs. For example, *Dicraeosaurus* shows significantly longer neural spines in the anterior and more inclined spines in the posterior part of the caudal series compared to other Tendaguru taxa like *Wamweracaudia* and *Giraffatitan*, which presumably leads to a more constricted dorsiflexion of the anterior tail and lateral movement in the posterior tail. Caudal procoely, which has been linked with shear stresses in sauropods, is more pronounced and prevalent in the anterior part of the tail of *Wamweracaudia* compared to *Dicraeosaurus*, indicating a behaviour that required stabilization of the vertebral column against shear stresses. Comparing RoMs of different sauropod species from the same Formation may help to understand in what different ways those animals behaved and communicated within their respective herds whilst migrating over long distances, and possibly how they defended themselves against predators on those precarious journeys.

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[Talk] [student]

The perioral soft tissues of *Camarasaurus* (Sauropoda): a reconstruction based on a new investigation method for the analysis of quantitative and qualitative osteological correlates to the cranial rostral neurovascular system

Giacomo Gobbo[1*], Simone Maganuco, Fabio Manucci, Nils Knötschke[2], Yolanda Schicker-Siber[2] & Dennis Hansen[3]

[1]Department of Biological, Geological, and Environmental Sciences, Alma Mater Studiorum, University of Bologna, Bologna, Italy;
[2] Sauriermuseum Aathal, Aathal, Switzerland;
[3] Department of Evolutionary Biology and Environmental Studies, University of Zurich, Zurich, Switzerland;
[*] giacomo.gobbo@studio.unibo.it – presenting author

Keywords: *Camarasaurus*, rhamphotheca, perioral soft tissues.

A rostral rhamphotheca, a highly keratinized tissue covering the perioral region of the skull, has been hypothesized for many sauropodomorphs and eusauropods over the past few decades by several authors, based on dental, morphological, and neurovascular evidence. However, to this day, no objective and comprehensive study has assessed and tested this hypothesis. The following study aims to present the first analytic method for investigating and reconstructing the perioral tissues in a fossil archosauromorph, using the *Camarasaurus* specimen SMA 0002, previously studied for the potential presence of a robust connective gingival tissue, as the first subject. In addition, an extensive dataset of modern eusuchians, chelonians, lepidosaurs, and birds was examined to define different reference models for each possible tissutal condition: carnous lips (lepidosaurs), rhamphothecae (birds and chelonians), and an exposed dentition (eusuchians). The investigative method is based on two main components of analysis, aimed at characterizing the osteological correlates associated with the rostral neurovascularization of the skull, linked to the type of perioral tissue developed and supported. The first component consist of a quantitative statistical examination of the number, morphology, and distribution of neurovascular foramina within the premaxillary, maxillary, and dentary bones. Principal

component analysis, linear discriminant analysis, and binomial correlations were conducted to define the distribution range of the reference models and to test whether *Camarasaurus* fits within one of them. The second component of the analysis involves a qualitative assessment of the osteological correlates associated with different tissue conditions, defining several distinct characters within each dental arch and identifying the qualitative traits associated with each reference tissue condition. The different traits describe how the neurovascular sytem develops and extends into the perioral region within the reference models, allowing for comparison and association with the species under investigation. The results revealed that *Camarasaurus* exhibited values comparable to those of modern birds, which served as the reference model for the development of a rhamphotheca-like covering, with the main function of protection and mechanical support for the dentition. The probable morphology and extension of this keratinized tissue were described based on the information provided by the neurovascular correlates. Moreover, given the numerous species that exhibit a similar condition within the *Sauropodomorpha* clade, this tissutal condition is proposed to be congenital for the lineage, initially developing rostrally in sauropodomorphs and then expanding caudally over the entire perioral region and dentition in more derived eusauropods.

[Talk] [non-student]

Vertebrate microfossil assemblages from the Lourinhã formation (Portugal, Late Jurassic)

Alexandre R. D. Guillaume[1,2,*], Vicente D. Crespo[1,2], Alexandra E. Fernandes[3], Arthur Maréchal[1], Filippo Maria Rotatori[1,2], Eduardo Puértolas-Pascual[1,4], André Saleiro[1,2], Cristina Sequero[5], Lope Ezquerro[4,5] & Miguel Moreno-Azanza[1,4]

[1] GEOBIOTEC, Department of Earth Sciences, NOVA School of Science and Technology, Universidade Nova de Lisboa, Caparica, Portugal;
[2] Museu da Lourinhã, Lourinhã, Portugal;
[3] American Museum of Natural History, Division of Paleontology, New York, USA;
[4] Aragosaurus: Recursos Geológicos y Paleoambientes – IUCA. Departamento de Ciencias de la Tierra, Universidad de Zaragoza, Zaragoza, Spain;
[5] Departamento de Geodinámica, Estratigrafía y Paleontología, Universidad Complutense de Madrid, Madrid, Spain;
[*] alexandre.guillaume.763@gmail.com – presenting author

Keywords: Palaeoecology, palaeodiversity, palaeoenvironment, microvertebrates, Lusitanian Basin.

Vertebrate Microfossil Assemblages (VMAs) capture a time-averaged, accurate record of their surrounding palaeocommunities, with consistent taphonomic history and reliable signals for palaeo-metacommunity analyses. Portugal (notably the Guimarota beds) is key for the Upper Jurassic, though other sites have been less explored. We sampled five Lourinhã formation localities, processing one ton of sediment and identifying 4,406 vertebrate fossils among over 20,000 remains, with Valmitão being the most productive locality. However, the rarefaction curve has not yet reached a plateau and instead presents a gradual pace towards the end, as observed in the locality of Zimbral. Meanwhile, the sampling is not finished yet in the Porto das Barcas locality. Unfortunately, the Porto Dinheiro and Peralta localities were not sampled enough to provide significant data for statistical analyses.

The variegated colors and lack of horizons, coupled with more carbonate nodules and rhizocasts in the Valmitão locality, suggest an environment with low sediment supply and long periods of subaerial exposure. The greyish sediments in Zimbral exhibit coal remains and poor development of rhizoliths or carbonate nodules, relating to oscillations in the water availability and implying an area of alternating conditions between wet and dry periods. Finally, the very low degree of pedogenesis and the dark-colored materials of the Porto das Barcas site indicate wetter conditions, probably associated with a permanent sheet of water and anoxic environments.

All localities yielded a multi-individual, multi-taxic accumulation of fragmented, isolated bones. As observed in most VMAs, scales and isolated teeth are the most common vertebrate elements picked. Osteichthyes, Crocodylomorpha, and Lissamphibia are the most represented clades, while Dinosauria, Mammaliaformes, and Crocodylomorpha are the most diverse. All localities are dominated by facultative and amphibious taxa, but this trend is much more marked in Valmitão, suggesting it was more continental than the other two. Relatively, Zimbral appears the most diverse in amphibious taxa, and with more obligate taxa than Valmitão, which would suggest a terrestrial, but more coastal, ecosystem. Finally, Porto das Barcas is less diverse in amphibious taxa, but more diverse in obligate taxa than the other two, suggesting a marine influence. This is congruent with the large number of bivalve shell fragments recovered in this locality and its sedimentological interpretation. This study highlights the mosaic of transitional to continental depositional environments represented within the Lourinhã formation, providing a unique opportunity to explore different ecosystems and their associated faunas within the same geographic area, age range, and geological unit.

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[Talk] [non-student]

Squamate reptiles from the Early to Middle Miocene of equatorial Eastern Africa reveal the origins of modern biodiversity

Jason Head[1,*], Michelle Lawing[2], Fredrick Kyalo Manthi[6], Johannes Müller[7], Abigail S. Hall[3], Samuel Muteti[6], Daniel J. Peppe[8], Susanne Cote[4] & Kieran P. McNulty[5]

[1] Department of Zoology, University of Cambridge, Cambridge, United Kingdom;
[2] Texas A&M University, College Station, Texas, USA;
[3] University of Minnesota, Minneapolis, Minnesota, USA;
[4] University of Calgary, Calgary, Alberta, Canada;
[5] University of Minnesota, Minneapolis, Minnesota, USA;
[6] National Museums of Kenya, Nairobi, Kenya;
[7] Museum für Naturkunde, Berlin, Germany;
[8] Baylor University, Waco, Texas, USA;
[*] jjh71@cam.ac.uk – presenting author

Keywords: Squamata, Miocene, Kenya, palaeoclimate, biogeography.

The modern tropics hold the highest species richness and ecological diversity. This is especially so for hyperdiverse vertebrate clades such as Squamata, but the origins and environmental correlations to the diversification of tropical squamates are poorly understood. In the case of Africa, molecular phylogenetic analyses indicate initial continental-scale immigration with subsequent endemic diversification roughly constrained to the middle to late Paleogene. More precise temporal resolution of these events, and their relationship to environment, require analysis of a fossil record that has been previously understudied. New discoveries from field research within the Nyanza Rift of western Kenya combined with historical collections have produced a record of >1,200 specimens from localities dated between 19.5–13.7 Ma. With the highest concentrations of specimens derived from localities associated with the Tinderet and Kisingiri volcano systems, these collections provide the best record of early Neogene reptiles for Africa and equatorial latitudes globally.

Lizards are represented predominately by acrodontans and varanids, with rarer occurrences of scincoids and lacertoids. Chamaeleonids are by far the most abundant taxon within Tinderet localities, whereas Kisingiri localities are more taxonomically diverse. Amphisbaenians are ubiquitous throughout the squamate record, including both large and small-bodied taxa. Snakes are the most diverse and abundant squamates. They include small to medium-sized pythonids, a single typhlopid record, aniliids from some Tinderet sites, and a single record of Erycidae from the Tinderet site of Songhor. Three specimens from the Middle Miocene represent the youngest African record of Tropidophiidae in Africa by ~15–20 million years. Elapoids are the most diverse snakes and include multiple lamprophiid and elapid taxa. The elapoid record demonstrates that diversification within constituent clades had occurred by the Early Miocene, consistent with molecular phylogenetic estimates. Patterns of occurrence are also consistent with isotopic and palaeobotanical studies that indicate strong environmental heterogeneity during the early Neogene. Community body size structure and taxonomic composition at different localities reflect local habitats ranging from closed forests to patchy, partially open environments. These associations suggest that habitat variability may have been a key driver in squamate diversification in Eastern Africa.

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[Poster] [non-student]

Multiple solutions to selective breeding for endurance running indicate variation of adaptive response in the lumbar morphology

Jesse J. Hennekam[1,2,*], Elizabeth Web[3], Theodore Garland Jr.[4], Nicole Schwartz[4], Eleanor Strickson[3] & Katrina E. Jones[3]

[1] Maastricht Science Programme, Faculty of Science and Engineering, Maastricht University, The Netherlands;
[2] Naturalis Biodiversity Center, Leiden, The Netherlands;
[3] Department of Earth and Environmental Sciences, University of Manchester, United Kingdom;
[4] Department of Evolution, Ecology, and Organismal Biology, University of California, USA;
[*] j.hennekam@maastrichtuniversity.nl – presenting author

Keywords: Functional morphology, geometric morphometrics, artificial selection.

Understanding the complex relationship between form and function is at the heart of evolutionary biology. Artificial selection studies can provide new insights into adaptive evolution, aiding the interpretation of the functional morphology of extinct taxa. Here we investigate the correlation between vertebral morphology and running behavior in mice. We compared four artificially selected lines of mice exhibiting increased running capabilities with four non-selected control lines using 3D geometric morphometrics of the ten most caudal vertebrae (n = 200). Morphological variation was measured within and among the high runner (HR) and Control (C) lines. HR lines were more variable among lines, but less variable within lines, compared with the C lines. In addition, HR lines varied more in thoracic and lumbar count, with one HR line showing a consistent shortening of the lumbar region. All HR lines seem to have evolved unique vertebral morphology during artificial selection, suggesting multiple "solutions" to a single adaptive challenge. This study indicates the versatility of the vertebral column with respect to directional selection on behavior, suggesting evolutionary principles that can be applied in a broader context.

[Talk] [non-student]

Osteohistology of the Eocene notosuchian crocodyliform *Sebecus icaeorhinus* and the evolution of growth dynamics in Notosuchia with implications for survivorship across the K-Pg mass extinction

Devin K. Hoffman[1,*], Cecily S.C. Nicholl[1] & Philip D. Mannion[1]

[1] Department of Earth Sciences, University College London, London, United Kingdom;
[*] dkf.hoffman@gmail.com – presenting author

Keywords: Notosuchia, Sebecosuchia, palaeohistology, life history, microanatomy.

Notosuchia is a clade of extinct, primarily terrestrial crocodyliforms that were especially diverse in the Cretaceous, although only one lineage, Sebecoidea, survived the K-Pg mass extinction. Palaeohistological investigations over the past decade indicate that notosuchians were ectothermic, but show a variety of fast and slow growth rates, with substantial qualitative differences between closely related taxa. This variation appears to be unrelated to patterns of body size, so it is unclear what is driving these differences in growth dynamics within Notosuchia. Additionally, very little is known about the palaeohistology of Cenozoic notosuchians, with only the Eocene European species, *Iberosuchus macrodon*, currently sampled. To address this, we describe the bone microstructure and histology of *Sebecus icaeorhinus* from the middle Eocene of Argentina, based on a mid-shaft section of the femur of the holotype individual. The primary cortical bone is composed primarily of sparsely vascularized parallel-fibred bone. The density of vascularization decreases towards the periosteal surface and is formed of simple vascular canals. Growth marks, in the form of lines of arrested growth, are poorly defined, such that assessing skeletal maturity and measuring growth is difficult. However, what is preserved indicates the individual was still growing and the lack of an external fundamental system indicates the individual had not reached skeletal maturity. The cortical bone preserves numerous Sharpey's fibres, particularly in the anterolateral quadrant of the section. Notosuchians are generally interpreted as primarily terrestrial; however, analysis with BoneProfileR recovers parameter values (P = 0.591; S = 0.056) consistent to that of all crocodylians with a tubular bone and moderate compactness;

thus, terrestriality is not strongly reflected in the bone density profile. When compared to other notosuchians, *Sebecus icaeorhinus* appears to be more similar to slower growing taxa such as *Araripesuchus buitreraensis* and *Iberosuchus macrodon*. Although sample size is small, with *Iberosuchus macrodon* and *Sebecus icaeorhinus* the only histologically sampled notosuchians from the Cenozoic, it is possible that slow growth was key to the survival of the sebecoid notosuchian lineage through the K-Pg extinction.

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[Talk] [non-student]

Exploring the post-canine mandibular dentition of *Ouranopithecus macedoniensis* (Primates, Hominoidea): a 3D approach

Melania Ioannidou[1,*], George D. Koufos[2] & Katerina Harvati[1,3]

[1] Eberhard-Karls University of Tübingen. Palaeoanthropology, Senckenberg Center for Human Evolution and Palaeoenvironment, Department of Geosciences, Tübingen, Germany;
[2] Aristotle University of Thessaloniki. School of Geology, Laboratory of Geology & Palaeontology, Thessaloniki, Greece;
[3] Eberhard-Karls University of Tübingen. DFG Center for Advanced Studies 'Words, Bones, Genes, Tools', Tübingen, Germany;
[*] melania.ioannidou@uni-tuebingen.de – presenting author

Keywords: Miocene hominoids, *Ouranopithecus*, mandibular dentition, virtual anthropology, 3D imaging.

Known from the Late Miocene deposits of Northern Greece, *Ouranopithecus macedoniensis* (~9.6 to 8.9 Ma) is one of several Eurasian hominoids from the Miocene epoch. Although its precise phylogenetic position remains unresolved – variously proposed as a stem hominid, stem hominine, stem pongine, or early hominin – ongoing analyses, including those utilizing 3D imaging methods, continue to provide valuable data and deepen our understanding of its evolutionary significance.

Despite the discovery of numerous cranial and dental remains of *Ouranopithecus macedoniensis*, aspects of its internal dental anatomy, particularly mandibular root and pulp canal morphology, have remained understudied. In this study, high-resolution 3D imaging methods were applied to a sample of partial mandibles from Ravin de la Pluie (RPl) and Nikiti (NKT) localities, whose internal dental features have not been previously investigated.

Our findings reveal a generally consistent pattern in root and canal number across individuals, with variation present, most notably in the premolars. In some specimens, the premolars showed a reduction in their root and pulp configuration, a feature that has been proposed as potentially indicative of hominin affinities. Our results, therefore, impact the interpretation of

Graecopithecus freybergi, another much-discussed Late Miocene hominoid taxon from Southeastern Europe, suggesting that root and pulp canal reduction may reflect broader Miocene hominoid variability rather than a hominin-specific trait. Importantly, the results of this study introduce previously undocumented variation within *Ouranopithecus macedoniensis*, contributing new data to comparative studies of Miocene hominoid dental diversity.
While this study does not aim to resolve the species' phylogenetic position, our study expands our knowledge on the largely unstudied internal dental structures of *Ouranopithecus macedoniensis* using 3D techniques. These results can offer new comparative data contributing to ongoing discussions on Miocene hominoid dental variation.

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[Talk] [non-student]

Early Burdigalian natricid snakes (Serpentes, Colubroidea) from Central Europe

Martin Ivanov[1,*] & Václav Paclík[1,2]

[1] Department of Geological Sciences, Faculty of Science, Masaryk University, Brno, Czech Republic;

[2] South Moravian Museum in Znojmo, Znojmo, Czech Republic;

[*] mivanov@sci.muni.cz – presenting author

Keywords: Early Miocene, Natricidae, comparative osteology, taxonomy, evolution.

The late Early Miocene (20.44–15.97 Ma; Burdigalian) was a period of massive dispersal of colubriform snakes in Europe. Although natricid snakes represented the most widespread colubroid clade in the European early Burdigalian (~late MN 2 and most of MN 3; 20.4–18.2 Ma), only two genera have been reported so far from the MN 3 zone – *Natrix* and '*Neonatrix*'. Here we present up to date insight on the taxonomy of European early Burdigalian natricids based mainly on the postcranial anatomy of diverse snakes from two coeval (MN 3) Central European localities, Merkur-North (Ahníkov I), Czechia and recently studied Wintershof-West, Germany. We confirmed the presence of at least three natricid genera in the early Burdigalian of Central Europe (*Natrix*, *Palaeonatrix*, and a new genus more closely related to *Natrix* than any other Natricidae). Among known natricids, *Palaeonatrix* has its first occurrence in MN 3. *Palaeonatrix* aff. *lehmani* from Wintershof-West which displays a peculiar development of the hypapophysis compared to all other extinct or extant natricids, represents a distinct morphotype slightly different from the type material of *Palaeonatrix lehmani* from Dolnice, Czechia (MN 4b). It is possible that *Palaeonatrix* aff. *lehmani* from Wintershof-West might belong to the evolutionary older members of *Palaeonatrix lehmani* lineage. The genus *Natrix* is represented by two species, *Natrix merkurensis* and *Natrix sansaniensis*, having their first occurrence in MN 3 zone. Although isolated cranial bones (compound bone, quadrate, ectopterygoid, and maxilla) have rarely been described in *Natrix merkurensis* and *Natrix sansaniensis* in Merkur-North (Ahníkov I), important braincase elements, being of crucial importance for the genus

level allocation, are absent. Therefore, the earliest indisputable representative of *Natrix*, identified on the basis of the fragmentary posterior portion of the parabasisphenoid, comes from the middle Burdigalian (MN 4) of Echzell, Germany, although we consider that its allocation to *Natrix longivertebrata* is unlikely. The simultaneous appearance of the extinct *Natrix merkurensis* and *Natrix sansaniensis* in the early Burdigalian (MN 3) of Central Europe supports the assumption of a rapid diversification of the *Natrix* lineage about 20–18 Ma supported by molecular studies. We consider the Eurasian small sized natricid morphotype from Wintershof-West, which closely resembles that of '*Neonatrix*' *crassa*, a member of the lineage different from the North American *Neonatrix* and most probably belonging to a separate/new genus. The early Burdigalian dispersal of Natricidae and other diversified colubriform snakes was a fundamental event in the evolution of modern European snake fauna closely related to humid conditions and warming preceding the thermal optimum of the Miocene Climatic Optimum.

[Poster] [student]

A vertebrate trace fossil assemblage from the "Jarugi" Valley in Broniszowice (Holy Cross Mountains, southeastern Poland)

Stanisław Jedynak[1,*]

[1] Faculty of Biology, University of Warsaw, Warsaw, Poland;
[*] s.jedynak2@student.uw.edu.pl – presenting author

Keywords: Ichnology, Buntsandstein, Vertebrate Trace Fossils, Broniszowice.

Regardless the huge amount of effort put in the studying of the Early and Early Middle Triassic of Poland, invariably most of the geographical dislocation of the accessible subsurface strata remains poorly documented. The lack of valid data is significantly more noticeable in Northern Mesozoic Margin of the Holy Cross Mountains (HCM) in southeastern Poland. Despite accommodating such famous geological sites as Wióry or Czerwona Góra, a whole lot of excellent exposures of the isochrone in the region have been gradually abandoned throughout the past decades. Some of the former quarries in the area are now unreachable. Sometimes, however, long gone opportunities in this field of research suddenly resurface. Recently, in the Broniszowice village in the southernmost part of Ostrowiec Świętokrzyski County (northeastern HCM) minor roadwork uncovered several outcrops of sedimentary rock. The outcropping strata are very fossiliferous and have been repeatedly reported as such for nearly a century, alongside with other observable sites in the "Jarugi" Valley, which is the common literature name for this locality. In this poster we present newly acquired data as well as an overview on the current state of research on the "Krynki Layers" strata ("Warstwy z Krynek" i Polish) which refers to the Uppermost Buntsandstein (Rötton Formation) sedimentary level (Middle Triassic, Anisian) in the HCM. The poster provides a detailed insight into the youngest Buntsandstein, marked by the occurrence of structural fossils of equisetopsid (Equisetopsida) plants, fossil plant pulp and lingulid (Lingulida) brachiopod trace fossils, sparking guesses about an actual strength of the influence of brackish environments in the Germanic Basin at the dusk of Bunter Sandstone and the dawn of Muschelkalk. Most importantly we document new finds of vertebrate trace fossils, including *Isochirotherium* isp. (Archosauria, Pseudosuchia) and likely footprints of a kannemeyeriiform (Therapsida, Dicynodontia) footprints from two different sandstone shoals in the "Krynki Layers" rocky formation in Broniszowice. The presented data will hopefully contribute to our knowledge of the even still mysterious Early and Early Middle Triassic of HCM in southeastern Poland.

[Poster] [student]

Changes in brain size and morphology in the Late Pleistocene–Holocene insular bovid *Myotragus balearicus* and close relatives

Tristan Wilhelm Jockheck[1,*], Pierre Orgebin[1,2], Josep A. Alcover[3], Pere Bover[4], Gertrud Rößner[5,6] & Roberto Rozzi[1,2]

[1] Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[2] Natural Sciences Collections, Martin Luther University Halle-Wittenberg, Halle (Saale), Germany;
[3] Departament de Biodiversitat Animal i Microbiana, Institut Mediterrani d'Estudis Avancats (UIB-CSIC), Esporles, Mallorca, Spain;
[4] ARAID Foundation, Instituto Universitario de Investigación en Ciencias Ambientales (IUCA) – Grupo Aragosaurus, Universidad de Zaragoza, Zaragoza, Spain;
[5] Staatliche Naturwissenschaftliche Sammlungen Bayerns - Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany;
[6] Department für Geo- und Umweltwissenschaften, Paläontologie und Geobiologie, Ludwig-Maximilians-Universität München, Munich, Germany;
[*] Wilhelm.Jockheck@gmx.de – presenting author

Keywords: Island evolution, endocast, geometric morphometrics.

Insular mammals are renowned for their peculiar evolutionary pathways. These taxa often display a suite of differences in morphology, ecology and behavior compared to their mainland counterparts, referred to collectively as the "Island Syndrome". Alterations in brain size and morphology have been reported for some insular dwarf mammals, yet data are scarce and quantitative analyses of changes in their brain shape are lacking. Here, we present the first digital endocasts of *Myotragus balearicus*, the last living representative of an extinct Caprini lineage endemic to the Balearic Islands, reassess its brain mass and anatomy, and provide the first brain mass estimation for *Nesogoral melonii*, an Early Pleistocene caprin endemic to Sardinia. We compare the endocranial morphology of these Western Mediterranean Caprini

with that of close relatives and analyze brain size and shape variation across 17 representatives of this tribe. Our results show a pronounced brain mass reduction in *Myotragus balearicus*, while *Nesogoral melonii* exhibits only a minor reduction. Results of geometric morphometric analyses indicate that, in response to the unique characteristics of its insular environment – characterized by limited resources and release from predators and competitors – *Myotragus balearicus* evolved a distinct brain shape, including a flattened frontal lobe and a reduced temporal lobe. Conversely, *Nesogoral melonii* retained a brain shape more similar to that of mainland Caprini, likely reflecting the presence of an apex predator, the running hyaena *Chasmaporthetes melei*, on Sardinia. All in all, our findings confirm previous qualitative hypotheses about *Myotragus'* brain evolution using new quantitative methods and provide insights into the evolution of brain mass and shape in *Nesogoral*, highlighting divergent patterns of brain evolution in these insular taxa.

[*Invited lecture*]

New insights into the evolution of trionychid turtles

Walter G. Joyce[1,*]

[1] Department of Geosciences, University of Fribourg, Switzerland;
[*] walter.joyce@unifr.ch – presenting author

Keywords: *Testudines*, *Pan-Trionychidae*, morphology, taxonomy, phylogeny.

Soft-shelled turtles (*Pan-Trionychidae*) are an unusual group of cryptodires characterized by the secondary reduction of the shell. Although representatives of this clade are particularly common in the fossil record, its evolutionary history is still poorly understood for a number of reasons. First, soft-shelled turtles display a high amount of continuous, intraspecific variation to the shell and skull, which are the most common elements to be found in the fossil record and the primary source of phylogenetic data. This variation, which is the combined result of ontogeny changes and morphological plasticity, had been ignored historically when assessing diversity. As a result, new species were named until quite recently based on nuanced differences, resulting in a taxonomic quagmire implying biologically implausible levels of past diversity. And second, soft-shelled turtles exhibit high levels of homoplasy making it difficult to ascertain an authentic phylogenetic signal.

In my talk, I will summarize ongoing progress in resolving the evolutionary history of trionychids. Important aspects are the relatively recent discovery of well-preserved Early Cretaceous representatives of the group that closely resemble their modern counterparts, a global alpha taxonomic revision, new insights into the anatomy of fossil trionychids using digital data, and expanded phylogenies that address the above noted intraspecific variation by extensively utilizing quantitative characters, scoring taxa using frequencies, and employing the molecular signal to evaluate search strategies.

[Talk] [student]

A new sphenodontian (Lepidosauria, Rhynchocephalia) from the Late Jurassic of Wattendorf, Germany

Toshiro Jujihara[1,*], Victor Beccari[2,3], Rachel C.M. Warnock[1] & Oliver Wings[4]

[1] GeoZentrum Nordbayern, Friedrich-Alexander-University Erlangen, Erlangen, Germany;
[2] SNSB, Bayerische Staatssammlung für Paläontologie und Geologie München, Munich, Germany;
[3] Department of Earth and Environmental Sciences, Ludwig-Maximilians-Universität, Munich, Germany;
[4] SNSB, Staatliche Naturwissenschaftliche Sammlungen Bayerns, Natural History Museum Bamberg, Bamberg, Germany;
[*] toshiro.a.jujihara@fau.de – presenting author

Keywords: Rhynchocephalia, Torleite Formation, Late Jurassic, Bavaria.

Fieldwork in Late Jurassic (upper Kimmeridgian) marine limestones at Wattendorf of the Franconian Jura in Bavaria, southern Germany, has revealed an almost complete, articulated, exceptionally well-preserved sphenodontian reptile. The specimen NKMB (Naturkundemuseum Bamberg) Watt 01314 (known colloquially as “Dreibein” (three-leg)) preserves the skull and lower jaw, articulated axial series, and an almost complete appendicular skeleton, missing only the right hindlimb. Although the Late Jurassic sphenodontians of the Solnhofen Archipelago in Germany have been studied since the mid-19th century, our knowledge of their taxonomy remains limited due to outdated descriptions and a poor understanding of their anatomy. Consequently, examining this specimen originating from the oldest section of the stratigraphic sequence of the Solnhofen Archipelago is particularly significant for gaining insights into the early evolution and distribution of this enigmatic group of reptiles within the region.

“Dreibein” exhibits features such as a long postorbital region that exceeds the length of the preorbital region, a narrow and anteroposteriorly elongated supratemporal fenestra, and a tail with laterally compressed caudal vertebrae, showing clear sapheosaurid affinities.

Additionally, it has an interdigitate suture between the ectopterygoid and jugal, reminiscent of the condition otherwise observed in *Oenosaurus muehlheimensis*, which could be a unique trait of this clade.

Our preliminary Bayesian phylogenetic analysis, using a reviewed dataset of morphological characters, recovers the monophyly of Rhynchocephalia (pp = 99) and "Dreibein" as a non-sphenodontid neosphenodontian closely related to sapheosaurids. This specimen is placed in a clade together with *Vadasaurus herzogi*, the juvenile specimen from Brunn SNSB-BSPG (Bayerische Staatssammlung für Paläontologie und Geologie München) 1993 XVIII P12, and as the sister taxon to the Sapheosauridae.

Based on its unique cranial and postcranial morphology, "Dreibein" possibly represents a new taxon, which adds another element to the palaeobiota of the tropical shallow marine environment suggested for the Torleite Formation in the Late Jurassic Wattendorf Plattenkalk, contributing to the diversity and distribution of sphenodontians in the Solnhofen Archipelago.

[Talk] [student]

The Late Miocene hornless rhinocerotids (Perissodactyla) from Samos Island (Greece)

Panagiotis Kampouridis[1,2,*], Georgia Svorligkou[3], Nikolaos Kargopoulos[4], Nikolai Spassov[5] & Madelaine Böhme[1,2]

[1] Department of Geosciences, Eberhard Karls University of Tübingen, Tübingen, Germany;
[2] Senckenberg Centre for Human Evolution and Palaeoenvironment, Tübingen, Germany;
[3] Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens, Athens, Greece;
[4] Departamento de Ciencias de la Tierra, and Instituto Universitario de Investigación en Ciencias Ambientales de Aragón (IUCA), Universidad de Zaragoza, Zaragoza, Spain;
[5] National Museum of Natural History at the Bulgarian Academy of Sciences, Sofia, Bulgaria;
[*] pkampouridis94@gmail.com – presenting author

Keywords: Mammalia, Rhinocerotidae, taxonomy, Europe.

Rhinoceroses are represented by only five species today, which are characterised by the presence of a nasal horn. In the past, however, rhinoceroses were much more diverse, with one of the most abundant groups being the Aceratheriinae, commonly referred to as hornless rhinos. Within that group, Chilotheriina, also known as chilotheres, represents a subtribe of hornless rhinoceroses that inhabited Eurasia during the Late Miocene. Their westernmost geographical distribution reached Eastern Europe, where they lived in an area mainly covering the Balkan Peninsula but stretching as far as the northern coast of the Black Sea. In this very restricted geographical area in Europe, in total eight different *Chilotherium* species have been erected, the validity and potential relationships of which have been heavily debated over the last century. Four of these species were described based on material from the Upper Miocene of Samos Island (Greece). Unfortunately, the type skulls of all four species from Samos are lost and there are several issues concerning their taxonomy. Therefore, we conducted a detailed revision of all available material of the hornless rhinocerotids from Samos, designating two skulls housed in historical collections from Samos as neotypes for the two valid species, *Chilotherium*

schlosseri and *Eochilotherium samium*, and provided detailed comparisons for the distinction of the species from each other and from any other chilothere. Our results show that the two species differ significantly from each other in their cranial morphology, justifying their separation on a generic level. The other two chilothere species from Samos, *Aceratherium wegneri* and *Aceratherium angustifrons*, represent junior synonyms of *Chilotherium schlosseri*, which seems to be more closely affiliated with the other European *Chilotherium* species and the type species of the genus *Chilotherium anderssoni* from the Late Miocene of China. As it regards *Eochilotherium samium*, this second Samos chilothere species is more similar to the Chinese '*Chilotherium*' *wimani* and '*Chilotherium*' *primigenium*, based on their more plesiomorphic characters. The fact that the closest relatives of both species are found outside Europe suggests that *Chilotherium schlosseri* and *Eochilotherium samium* dispersed independently from each other into Europe. The two chilothere species co-occur in Samos with two horned rhinos during the Late Miocene. These four rhinocerotid species were most probably able to coexist in Samos due to niche partitioning, which would allow them to limit the competition over food sources.

[Talk] [student]

Taxonomy, morphology, and phylogeny of a nearly complete nanhsiungchelyid (Testudines) specimen from the Upper Cretaceous of the Nanxiong Basin, China

Yuzheng Ke[1, 2,*], Zhongye Shi[3], Haiyan Tong[4,5], Bicheng Li[3], Yunfei Zhang[3], Fenglu Han[1] & Walter G. Joyce[2]

[1] School of Earth Sciences, China University of Geosciences, Wuhan, China;
[2] Department of Geosciences, University of Fribourg, Fribourg, Switzerland;
[3] Shanghai Natural History Museum, Shanghai Science and Technology Museum, Shanghai, China;
[4] Palaeontological Research and Education Centre, Mahasarakham University, Maha Sarakham, Thailand;
[5] Institute of Vertebrate Palaeontology and Palaeoanthropology, Chinese Academy of Sciences, Beijing, China;
[*] key1480@163.com – presenting author

Keywords: *Nanhsiungchelys*, sexual dimorphism, phylogeny, Late Cretaceous, Nanxiong Basin.

Nanhsiungchelys, the type genus of Nanhsiungchelyidae, is an extinct turtle taxon that lived during the Late Cretaceous in southern China. It has a large carapace length (up to 115 cm), exhibits a pair of anterolateral processes on the carapace, and differentiated neurals and alternating costals. Despite having a relatively abundant fossil record, the taxonomy and plastral morphology of *Nanhsiungchelys* is not well understood. Here, we describe a large specimen of *Nanhsiungchelys* with an associated skull and shell (SNHM [Shanghai Natural History Museum] 1558) from the Upper Cretaceous of Nanxiong Basin, China. The skull of SNHM 1558 is similar to that of *Nanhsiungchelys yangi*, but the carapace bears a pair of stick-like anterolateral processes. For this reason, we tentatively refer SNHM 1558 to *Nanhsiungchelys* cf. *yangi*. A concave plastron and a narrower posterior lobe indicate that SNHM 1558 may be a male. The genus *Nanhsiungchelys* was regarded as the most advanced taxon of

Nanhsiungchelyidae, but some morphological characteristics suggest plesiomorphic similarities with the outgroup *Adocus* spp., such as the narrow pleural scutes 2–4 and the higher posterior marginal scutes. We reevaluate the most recent phylogenetic matrices of Nanhsiungchelyidae by rescoring all observations. The updated phylogenetic analysis suggests that *Nanhsiungchelys* spp. and *Anomalochelys angulata* form a monophyletic group that is the sister to all other nanhsiungchelyids. As *Anomalochelys angulata* and *Kharakhutulia kalandadzei* have been reported to originate from Cenomanian deposits, these two distinct nanhsiungchelyid lineages were present at least since the Cenomanian (~100.5–93.9 Ma).

[Talk] [student]

A new Argentinian cousin of the enigmatic *Chilesaurus* (Dinosauria) could help clarify its phylogenetic position

Maximilian Kellermann[1,*], Diego Pol[2] & Oliver W. M. Rauhut[1,3,4]

[1] Staatliche Naturwissenschaftliche Sammlungen Bayerns–Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany;
[2] Museo Argentino de Ciencias Naturales Bernardino Rivadavia, Buenos Aires, Argentina;
[3] Department für Geo- und Umweltwissenschaften, Sektion Paläontologie und Geobiologie, Ludwig-Maximilians-Universität, Munich, Germany;
[4] GeoBioCenter, Ludwig-Maximilians-Universität, Munich, Germany;
[*] maximilian.kellermann.paleo@gmail.com – presenting author

Keywords: Dinosauria, Argentina, *Chilesaurus*, Jurassic.

Chilesaurus diegosuarezi is an enigmatic dinosaur from the Upper Jurassic (Tithonian) Toqui Formation of Chile that was first described as a tetanuran theropod in 2015. However, the genus shows a combination of traits characteristic of the three major dinosaur groups: Ornithischia, Sauropodomorpha, and Theropoda, which has raised questions as to the phylogenetic position of the taxon, as well as the interrelations of the Dinosauria as a whole, with several authors having argued that *Chilesaurus* represents a late survivor of a lineage supporting the monophyly of Theropoda and Ornithischia in a group called Ornithoscelida. In 2019, at least three specimens of a new dinosaur taxon were found in a single large concretion derived from the slightly older Cañadón Calcáreo Formation (Oxfordian-Kimmeridgian) of Chubut Province, Argentina. Taking the different specimens together, this new, as of yet unnamed taxon, is known from an almost complete skeleton, with individuals from multiple different growth stages. The new taxon shows apomorphic similarities with *Chilesaurus*, including a functionally two-fingered hand and an opisthopubic pelvis, and thus seems to represent a closely related taxon. We present here newly prepared material of these specimens, which help clarify its position within the Dinosauria. Several traits are indicative of a position within the Theropoda, such as the well-developed, hooked preacetabular process of the ilium and the attachment of metatarsal

I laterally on the shaft of metatarsal II, while others, such as the largely apneumatic cervical vertebrae are present in both Ornithischia and non-sauropod Sauropodomorpha. In general, different characters of the new taxon are shared with representatives of all three major dinosaurian lineages, but, surprisingly, not necessarily with the earliest-branching taxa, such as the triangular outline of the distal tibia and a laminar ascending process of the astragalus (both characters of averostran theropods, but not more basal taxa). This indicates that the new taxon might be nested well within one of the major clades, rather than representing an early-branching lineage, so that characters shared with the other lineages would represent convergent features. A new extensive phylogenetic analysis of the Dinosauria will be carried out in the future, to further help clarify the position of these enigmatic dinosaurs. For this we are compiling three datasets with a respective focus on each of the three main groups, to avoid the sampling bias present in some of the earlier analyses.

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[Poster] [non-student]

Tracks of woolly rhinoceros (*Coelodonta antiquitatis*) from the Late Pleistocene of Bottrop, Germany

Charalampos Kevrekidis[1,*] & Dick Mol[2]

[1] Museum für Ur- und Ortsgeschichte, Museumszentrum Quadrat, Bottrop, Germany;

[2] Mammoth Laboratory, Historyland, Hellevoetsluis, The Netherlands;

[*] charalampos.kevrekidis@bottrop.de – presenting author

Keywords: Locomotion, Rhinocerotidae footprints, tracksite, Ice Age, Quaternary.

The track plate of Bottrop preserves a horizon that extends over 150 m^2 and preserves more than 600 tracks of late Pleistocene animals. Half of these tracks are arranged in 30 trackways. The surface has been extensively studied and published or in the 1990s when 16 trackways were attributed to reindeer (*Rangifer tarandus*), one to a cave lion (*Panthera spelaea*), and one to a wolf (*Canis lupus*). From the isolated tracks, the footprints of a possible goose (Anatidae) have been identified. The producers of the rest of the tracks are not known with certainty. The size, density of tracks, and diversity of represented taxa renders Bottrop as one of the most remarkable track surfaces from the Late Pleistocene. The sediments were dated by thermoluminescence to max. 35–42 Ka. The original horizon is not preserved, but a copy made of epoxy resin is stored in Bottrop. A part measuring 4 x7 m is on display at the Museum in Bottrop.

Here we report the identification of a new trackway from the surface. It comprises 16 tracks that range from 19–26 cm in diameter, making them some of the largest tracks on that plate. The stride is between 165–190 cm. Though it is clear that they belong to a large animal, little from the initial morphology of the foot has been preserved to allow identification. However, at least two tracks (HF-1-14/15) show a tell-tale shape: an anteriorly flattened and broad median hoof impression, surrounded by two smaller hoof impressions on either side. Such large candidate from that place and age can only be the perissodactyl woolly rhinoceros (*Coelodonta*

antiquitatis). Several bones of woolly rhinoceroses have been recovered from the sediments immediately below the track plate, along with bones of other large herbivores, such as reindeer, giant deer (*Megaloceros giganteus*), steppe bison (*Bison priscus*), aurochs (*Bos primigenius*), horse (*Equus* sp.), and woolly mammoth (*Mammuthus primigenius*). Other than *Megaloceros* and *Mammuthus*, the other large herbivores are suspected to be represented on the track surface, though their identification remains tentative. The tracks represent therefore a subset of the underlying fauna. The newly identified tracks help us bridge the gap between the osteological and ichnological fossil record of Bottrop. Future research and modern technologies could help decipher the rest of the tracks of the Bottrop track plate.

[Talk] [student]

Early theropods from Europe and the classification of non-averostran dinosaurs

João P. S. Kirmse[1,*], Cindy Howells[2] & Oliver W. M. Rauhut[1,3]

[1] Department für Geo- und Umweltwissenschaften, Ludwig-Maximilians-Universität München, Munich, Germany;

[2] Department of Natural Sciences, Amgueddfa Cymru - National Museum Wales, Cardiff, United Kingdom;

[3] Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany;

[*] j.kirmse@lrz.uni-muenchen.de – presenting author

Keywords: Theropoda, Coelophysoidea, CT scanning, phylogenetics.

Theropod dinosaurs experienced their first radiation during the Late Triassic. Historically, all early neotheropods were grouped within Coelophysoidea, but some taxa are now regarded as part of the grade leading to Averostra, indicating a broader phylogenetic diversity in the Triassic and early Jurassic. Nonetheless, uncertainties on the position of some taxa and on each clade's synapomorphies persist. One of the first European Triassic theropods to be published was *Procompsognathus triassicus*, from the Löwenstein Formation of southern Germany. It has long been recognised as key to understanding coelophysoid character evolution and is one of the reference taxa for the definition of Coelophysidae. More recently, *Dracoraptor hanigani* was reported from the Hettangian Blue Lias Formation of the cliffs of Southeastern Wales, representing the oldest known Jurassic theropod from Europe. Initially recovered as a coelophysoid, it was found as part of the Averostra line in more recent analyses. Both taxa are partially embedded in matrix, with various features obscured, and have not been reanalysed considering new discoveries. To reassess these taxa, the materials were CT-scanned and segmented for a complete and non-destructive 3D visualisation of the specimens and added to an inclusive and updated character-matrix. *Dracoraptor* preserves more elements than initially reported, including ectopterygoids and elements of the lower jaw. It had a very low olecranon and anterior cervical centra with a smooth posterior half, lacking pleurocoels or ridges.

Dracoraptor is found as a member of the Averostra line in a clade with *Dilophosaurus* and *Sarcosaurus*. The surfaces of the bones of *Procompsognathus* are cracked and the limits between elements can be hard to determine. Some of the traditional features stated to be present in the material are not visible in the holotype, such as astragalocalcaneal fusion. Others have been wrongfully identified, such as vertebral region boundaries. It has distinctive ridges on its posterior dorsal centra that are also seen in *Pterospondylus trielbae*, a taxon from northeastern Germany based on a single vertebra, usually regarded as a nomen dubium, which suggests it is instead a junior synonym of *Procompsognathus triassicus*. *Procompsognathus* is recovered as a deeply nested member of Coelophysoidea, in one of two subgroups of Coelophysidae, that is united by a rugose patch on the anterior distal tibia - which in *Procompsognathus* looks very similar to that in *Lepidus*. These specimens highlight not only how CT scanning adds to the interpretation of well-known fossils, but also that first hand examination of specimens and character coding can help to elucidate the apomorphies and composition of major groups.

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[Talk] [non-student]

Mibladen – an important mid-Cretaceous footprint locality in a mineral mine of the High Moulouya region, Central Morocco – palaeoecological implications

Hendrik Klein[1,*], Gerard Gierliński[2], Hafid Saber[3], Mostafa Oukassou[4], Jens N. Lallensack[5], Mustapha Amzil[4], Omar Zafaty[4,6] & André Charrière[7]

[1] Saurierwelt Paläontologisches Museum, Neumarkt, Germany;
[2] JuraPark, Bałtów, Poland;
[3] Laboratory of Geodynamic and Geomatic, Faculty of Sciences, Chouaïb Doukkali University, El Jadida, Morocco;
[4] Laboratory of Geosciences, Geomatics and Environment, Faculty of Sciences Ben M'sick, Hassan II University of Casablanca, Morocco;
[5] Departamento de Ciência da Computação, Universidade Federal de Minas Gerais, Belo Horizonte, Minas Gerais, Brasil;
[6] Institut National des Sciences de l'Archéologie et du Patrimoine, Rabat, Maroc ;
[7] Toulouse III University, Toulouse, France;
[*] Hendrik.Klein@saurierwelt.de – presenting author

Keywords: Turtles, Crocodylomorpha, Pterosauria, Dinosauria, Mammaliamorpha.

The Mibladen mine in the High Moulouya region of central Morocco is a famous locality for lead ore mining from Jurassic deposits taking place from the twenties to the seventies of the last century. It became a hotspot for both professionals and private mineral collectors yielding important specimens that can be found in numerous museum collections. More recently, the Cretaceous cover provided a diverse tetrapod ichnofauna comprising abundant footprints of theropod and ornithopod dinosaurs, pterosaurs, crocodylomorphs, turtles, and a few isolated mammaliamorphs. The footprints occur in red beds of the lower Midelt Formation (upper Barremian–?Aptian), which comprise sandstones and claystones deposited in a fluvial channel and deltaic floodplain environment. The age of the strata can be constrained by charophytes and foraminifera. Associated ichno- and body fossils include plant roots, invertebrate traces,

conchostracans, fish scales, and bone remains. The tetrapod footprints are preserved as concave epireliefs and convex hyporeliefs on upper/lower surfaces of a medium-fine-grained sandstone underlain by red or green claystone. Abundant are medium-sized to large tridactyl theropod footprints and trackways. They are similar to morphotypes described from the Cretaceous of Argentina, such as *Bressanichnus* and *Deferrariischnium*. A few isolated medium-sized tridactyl imprints can be referred to ornithopod dinosaurs resembling the ichnogenus *Iguanodontipus*. Pterosaurs are represented by trackways with pes and manus imprints similar to *Pteraichnus*. Remarkable is the record of turtle tracks referred to *Emydhipus* isp. and consisting of pes and manus imprints left by partially buoyant or bottom-walking semi-aquatic producers. These are broad trackways with short tridactyl-pentadactyl pes and manus imprints showing a concave plantar/palmar area. Digit traces are subparallel scratches with interdigital "webbing." Other common ichnofaunal elements are crocodylomorph traces that can be assigned to *Hatcherichnus* isp.; these are scratch marks of possibly buoyant or swimming forms. Rare components of the Mibladen ichnofauna are isolated small pes and/or manus imprints of mammaliamorphs, represented by small tetradactyl-pentadactyl impressions with long and slender digits, acuminate claws and a half-circular sole.

The diverse ichnofauna combined with known fish and invertebrate body fossils indicate a flourishing Cretaceous animal community in a coastal area, being a floodplain to brackish-deltaic environment where theropod dinosaurs and crocodylomorphs may have hunted on smaller pray such as turtles, fishes or occasional mammaliamorphs. Pterosaurs probably fed on fishes and invertebrates from shallow water along the coast. Herbivorous ornithopods indicate the presence of plants and sufficient water supply.

[Poster] [student]

Reconstructing marine vertebrate trophic networks and diversity in the Middle Triassic of the Germanic Basin

Lily Hardeveld ook genaamd Kleuver[1,*], Carlos Martinez-Perez[2] & Emilia Jarochowska[1]

[1] Department of Earth Sciences, Utrecht University, The Netherlands;

[2] Department of Geology, University of Valencia, Spain;

[*] l.a.hardeveldookgenaamdkleuver@students.uu.nl – presenting author

Keywords: Microfossils, marine vertebrates, Middle Triassic, trophic diversity, trophic levels.

During the Middle Triassic Europe was largely covered by an epicontinental sea known as the Germanic Basin. This environment was still recovering from the greatest extinction event of all time, the Permo-Triassic Mass Extinction (PTME). To investigate the structure and changes of marine trophic networks during this period, we analysed trophic diversity using Sr/Ca and Ba/Ca ratios from bioapatite in microfossil teeth of fish and reptiles. Lower elemental ratios indicate higher trophic levels, enabling reconstruction of relative trophic positions within the same stratigraphic layers. Microfossils were collected from two sites: Winterswijk, The Netherlands (Anisian Age) and Henarejos, Spain (Ladinian Age), both part of the Muschelkalk—a marine carbonate deposit of dolomites and limestones formed during the Middle Triassic. Taxa analysed include Osteichthyes (*Gyrolepis* sp., *Saurichthys* sp., Dapediidae), Chondrichthyes (*Acrodus* sp., *Lissodus minimus*, *Omanoselache butcheri*, *Pseudodalatias henarejensis*), and reptiles (*Nothosaurus* sp., cf. *Eusaurosphargis*, Placodontia). Previous analysis done on Winterswijk samples showed a trophic diversity of three levels with the Osteichthyes *Colobodus* sp. occupying the highest trophic level of this ecosystem. Due to the low sampling number, more data is added to this previous data set for this study to improve the reconstruction of Winterswijk's trophic diversity. By comparing trophic diversities across and within these two sites, this study provides insights into the timing and extent of ecological recovery and shifts in marine vertebrate communities following the PTME, contributing to a broader understanding of post-extinction ecosystem restructuring.

[Poster] [non-student]

Walking with Landcrocs – The Geiseltal graphic novel

Joschua Knüppe[1,*], **Oliver Wings**[2,*] & Jan Fischer[3]

[1] Independent researcher, Ibbenbüren, Germany;

[2] SNSB, Natural History Museum Bamberg, Bamberg, Germany;

[3] Urweltmuseum GEOSKOP / Burg Lichtenberg (Pfalz), Thallichtenberg, Germany;

[*] utahraptor.jo@web.de / wings@snsb.de – presenting authors

Keywords: Science communication, graphic novel, fossil Lagerstätte, Eocene.

The Geiseltal is a former open-pit lignite mining area in central Germany, south of Halle (Saale). In addition to its former economic importance, the name is closely linked to the fossils found there during coal mining between 1925 and 1993. Over 50,000 fossils, a plethora of animals and plant taxa, some in a unique state of preservation, provide unique insights into a subtropical terrestrial / palustrine Eocene ecosystem. The quality and quantity of fossils makes the Geiseltal a world-class Fossillagerstätte, but in the public awareness its importance was never fully recognized, overshadowed by the contemporaneous Messel pit.

To counteract this, we decided to visualize research results from the last 100 years and thereby bring the Eocene world back to life in a colourful way. Similar to a previous scientific communication project, the printed book EUROPASAURUS on Jurassic fossils from Northern Germany, the chosen communication medium is the graphic novel. The easily accessible visual format of comics offers the possibility to transmit scientific results to a broad audience. The graphic novel GEISELTAL is divided into two parts: 1) a documentary-like comic story section, with several chapters about exciting life stages of the land-living planocraniid crocodyliform *Boverisuchus* through the different Geiseltal habitats, and 2) a concise factual section, in which what was previously shown is further substantiated. The latter contains topics such as palaeogeography, history of finds and information about individual taxa on double-page spreads. The texts are written by specialists in the respective taxa, kept short and comprehensible, in German and English, and are supplemented by photographs of fossils and detailed reconstruction drawings. The result is a popular science graphic novel, that hopefully

makes the complex subject of the Geiseltal fossil deposit exciting, entertaining and visually immersive, but at the same time accurate and verifiable in terms of content; last but not least, accessible to all age groups.

In its aesthetics and storytelling, the book draws from popular documentaries like “Walking With Beasts”, countless nature photographs, and many artists from within as well as outside the palaeo circles. All illustrations were produced on paper using acrylic paint and Gouache and are based on scientific publications and expert feedback. This helps to create a style that is scientifically credible, but most importantly painterly and visually appealing in a way that it might outlive its usefulness as a scientific illustration but can still be inspirational for future generations.

Funding: Funding provided by the Volkswagen Foundation.

[Talk] [student]

Digital modeling of the caudal musculature in *Wamweracaudia keranjei* (Dinosauria, Sauropoda)

Anaëlle Kocher[1,*] & Verónica Díez Díaz[1]

[1] Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany;

[*] anaelle.kocher@gmail.com – presenting author

Keywords: Sauropoda, Tendaguru, *Wamweracaudia*, volumetric muscle reconstruction, tail.

Wamweracaudia keranjei is a Late Jurassic sauropod discovered in Tanzania at the Tendaguru Formation. This formation was deposited in the context of a marginal marine to continental setting with several marine transgression cycles. This deposition resulted in six geological members, with three of them having dinosaur remains. This region presented a rich diversity of sauropods, with seven species having so far been described. Such diversification suggests that these species could not have occupied the same ecological niche due to competitive exclusion. This enhances the question: what were the biological and behavioral differences between them? This study aims to contribute to answering this question by identifying the soft tissue osteological correlates of the tail of *Wamweracaudia keranjei*, and more specifically, the volumetric reconstruction of the epaxial and hypaxial musculature of the caudal region. In the case of *Wamweracaudia keranjei*, the Museum für Naturkunde in Berlin (Germany) houses the only known series of its caudal vertebrae, comprising 30 elements. These vertebrae are relatively smooth and lack prominent structural features.

While many studies have explored the biology and behavior of sauropods, only a few have provided detailed reconstructions of their tail musculature. This research is part of a broader project aiming to understand anatomical differences among Tendaguru sauropods and to develop biomechanical analyses to investigate their locomotor and behavioral adaptations. One of the most apparent differences between these species is their size. More specifically, their

caudal vertebrae exhibit significant variation in dimensions, morphology, and topology, such as bumps or depressions.

What do sauropod tails tell us about their locomotion and behaviour? Can we better understand issues such as migratory patterns thanks to volumetric reconstructions of their muscles? We expect that studies like the one presented here will become more common in multidisciplinary studies on the ecology of extinct animals.

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[Talk] [non-student]

Estimating early tetrapod neck mobility and stability using an extant analogue

Dana E. Korneisel[1,2,*], Linfang Han[3], Cassandra M. Donatelli[4], Thomas A. Stewart[5], Andrew L. Traynor[1], Benjamin K.A. Otoo[1], Tetsuto Miyashita[6,1], Emily M. Standen[3] & Hillary C. Maddin[1]

[1] Earth Sciences Department, Carleton University, Ottawa, Ontario, Canada;

[2] Department of Organismal Biology, Uppsala University, Uppsala, Sweden;

[3] Department of Biology, University of Ottawa, Ottawa, Ontario, Canada;

[4] Fowler School of Engineering, Chapman University, Orange, California, USA;

[5] Department of Biology, The Pennsylvania State University, State College, Pennsylvania, USA;

[6] Canadian Museum of Nature, Ottawa, Ontario, Canada;

[*] dana.korneisel@ebc.uu.se – presenting author

Keywords: Neck, biomechanics, tetrapod, notochord, cervical vertebrae.

As vertebrates made the transition from water to land, stem and early tetrapods acquired a variety of anatomical innovations. Modifications to the skull and limbs accompanied the separation of these anatomical units, decoupled by the first mobile necks. Eventually, differentiated cervical vertebrae would define this region of the axial column, but early in tetrapod evolution the cervical region was dominated by a notochord supported by discrete vertebral arches. Due to the elasticity expected of the notochord and low degree of hard-tissue contact in this type of neck, we hypothesized that both head elevation and lateral mobility as well as the earliest twisting motions of the head would be possible in stem and early tetrapods. To test whether these types of motion are feasible, we collected material data on the axial column and notochord of the lake sturgeon, *Acipenser fulvescens*. The lake sturgeon is similar in size to many relevant fossil taxa and is one of the few extant taxa to maintain a notochord-dominated axial column into adulthood. We measured flexural stiffness of the column and notochord as well as torsional stiffness on a universal testing machine. We then applied these

properties to the measured dimensions of the anteriormost axial column of five tetrapodomorph and tetrapod taxa to estimate the mobility and stability of the cervical region in each taxon. We found that the axial columns of all five taxa were surprisingly stiff, sufficient to limit dorsal flexion considerably as well as lateral bending and likely not allowing twisting motions of the head. All ranges of motion would be decreased from these estimates by the presence of surrounding tissues, but overall, the potential for head mobility declined in the crown group compared to stem tetrapods and was highly dependent on neck length. Mobility estimates were highest in the elpistostegalians, the Late Devonian *Tiktaalik roseae*, and in the particularly long-necked Early Carboniferous *Whatcheeria deltae*. These results illuminate the ways in which the biomechanical challenge of the transition to land were overcome as major anatomical shifts in the tetrapod line occurred to an axial-column supported body and suspended head. These results also highlight the value of the specialized cervical joints that evolved in later-occurring tetrapod taxa in maintaining and increasing head mobility even as the constituent vertebral components stiffened with increased ossification including that of the centra.

[Talk] [non-student]

Advances in the study of fish fossils in Ukraine over the last five years (2021–2025)

Oleksandr Kovalchuk[1,2,3,*]

[1] Department of Palaeontology, National Museum of Natural History, National Academy of Sciences of Ukraine, Kyiv, Ukraine;
[2] Department of Palaeozoology, Faculty of Biological Sciences, University of Wrocław, Wrocław, Poland;
[3] Department of Biology and Biology Teaching Methodology, Faculty of Natural Sciences and Geography, A.S. Makarenko Sumy State Pedagogical University, Sumy, Ukraine;
* biologiest@ukr.net – presenting author

Keywords: Chondrichthyes, Actinopterygii, Cretaceous, Paleogene, Neogene, diversity.

Over the past five years, significant advancements have been made in the study of fossil fish remains from the area of Ukraine. These studies were performed by researchers from different institutions in a close collaboration with colleagues from other countries. They have been focused on the morphology, taxonomy, diversity and palaeobiogeography of Mesozoic and Cenozoic fishes.

A series of new isolated teeth belonging to the extinct durophagous shark *Ptychodus* has been described from the Late Cretaceous of Ukraine. The taxonomic identification of these fossils reveals a diverse Cenomanian shark fauna which comprised both cuspidate and non-cuspidate species of *Ptychodus* from the coastal areas at the northwestern margin of the Ukrainian Massif. Jaw teeth of the genus *Enchodus* (Aulopiformes, Enchodontidae) were reported from the Cenomanian of Ukraine.

Fish remains from Paleogene deposits of the broader Kyiv area were first collected and described by O.S. Rogovich in the mid-19th century. We have carried out a re-examination of chondrichthyan fossils from Rogovich's collection and evaluated several later records, all of which were recovered from middle Eocene deposits. The sample revealed to a single chimaeriform species (*Edaphodon bucklandi*), and 12 shark and two ray taxa. 10 sharks were

identified to species level, whereas the rays (Myliobatiformes, Myliobatidae) could be identified only at higher systematic ranks.

Marine ecosystems of the Outer Carpathian Basin were dominated by bony fishes, but sharks also played an important ecological role. We described a series of shark teeth from six Ukrainian and Polish Oligocene localities, most of which are new to the basin. Records of *Isurolamna gracilis* and *Echinorhinus* sp. represent the first elasmobranch remains reported from the Oligocene of Ukraine.

We also described a new specimen of the fossil puffer fish *Archaeotetraodon winterbottomi* (Tetraodontidae) from the early Oligocene of Ukraine, a series of skeletal imprints of ponyfishes (Leiognathidae) identified as *Leiognathoides minutus* from the Early Miocene of Poland, as well as a number of interesting sturgeon fossils (Acipenseridae) from the terminal Miocene of Ukraine.

The late Badenian Medobory barrier reef in western Ukraine offers a unique opportunity to study a backreef fish fauna of the Middle Miocene Central Paratethys Sea mostly by means of otoliths. New sampling at five locations has considerably upgraded the fish fauna, which now comprises 62 species. 18 species from the Medobory barrier reef have been described as new to science. Syngnathids and gobiesocids are herewith for the first time identified in fossil otolith assemblages.

During the late Cenozoic, the southwest of Eastern Europe was a region affected by extensive hydrological transformations that resulted in the retreat of the Eastern Paratethys and the emergence of freshwater communities. In recent decades, a relatively rich fossil actinopterygian fauna has been described from this area. Our study was based on previous systematic studies and aimed to assess and trace the temporal dynamics of the diversity of fish assemblages that existed in the area from the Late Miocene until the end of the Pleistocene. The revealed temporal trends reflect the impact of the palaeoenvironmental and palaeoecological processes that characterised the region during the late Cenozoic, and the evolution of a typically limnophilous, lacustrine-riverine fish fauna.

The range of palaeoichthyological research is not limited to the above list. Thanks to the deepening of international cooperations, new areas of work are being developed, and joint projects are being prepared, which aim to shed light on the history of Cenozoic fish fauna of Eastern Europe.

[Poster] [non-student]

Type specimens of fossil viperid snakes (Serpentes) in the collection of the Department of Palaeontology of the National Museum of Natural History, National Academy of Sciences of Ukraine

Vadym Yanenko[1] & **Oleksandr Kovalchuk**[1,2,3,*]

[1] Department of Palaeontology, National Museum of Natural History, National Academy of Sciences of Ukraine, Kyiv, Ukraine;
[2] Department of Palaeozoology, Faculty of Biological Sciences, University of Wrocław, Wrocław, Poland;
[3] Department of Biology and Biology Teaching Methodology, Faculty of Natural Sciences and Geography, A.S. Makarenko Sumy State Pedagogical University, Sumy, Ukraine;
[*] biologiest@ukr.net – presenting author

Keywords: Squamata, type material, museum collections, Viperidae.

Type specimens stored in natural history collections are the cornerstone of biological research and taxonomy. They serve as the definitive reference point for describing and naming species. Researchers around the world can study type specimens to ensure their findings align with established classifications. This promotes collaboration and reduces confusion in scientific communication.

Natural history collections, including also type specimens, can occasionally "migrate" between scientific institutions within a city, country, or even between different countries. Such "migrations" can be caused either merging or separating institutions, or temporary transfer for processing. Some collections lost their curators and storage places for decades. Until the end of 1995, collections of the Department of Palaeontology of the National Museum of Natural History of the National Academy of Sciences of Ukraine (NMNHU-P) were part of the collections of I.I. Schmalhausen Institute of Zoology of the National Academy of Sciences of Ukraine (IZAN).

In the late 1980s and the early 1990s, Galina Zerova, the previous curator of the herpetological collection of NMNHU-P, described three extinct species of the family Viperidae as new to

science from the territory of Ukraine. Of them, the oldest is *Daboia ukrainica* from the late Middle–early Late Miocene of Grytsiv (Khmelnytskyi Oblast); the holotype was represented by a left maxilla (IZAN 22-1786), while the author had also referred to the same species also 27 other cranial elements (IZAN 22-1787 – 22-1814) and 100 "cervical", trunk and precloacal vertebrae. Another species is *Vipera meotica* from the Late Miocene of Cherevychne (Odesa Oblast); the holotype was a basiparasphenoid (IZAN 45-5023), and the author had also referred to the same species also 18 precloacal vertebrae (IZAN 45-5024 – 45-5041). The third viperid species is *Macrovipera kuchurganica* from the Early Pliocene of Kuchurgan (Odesa Oblast). The type series consisted of three trunk vertebrae (the holotype IZAN 37-2536 plus the paratypes IZAN 37-2537 and IZAN 37-2538).

After starting the re-inventory process, it was revealed the absence of type specimens representing *Daboia ukrainica* and *Vipera meotica* in the NMNHU-P collection, except for a single precaudal vertebra of *V. meotica* (IZAN 45-5024, new number – NMNHU-P AR-708) and the type series of *Macrovipera kuchurganica* (new number – NMNHU-P AR-705-707). In addition, 25 paratypes of another viperid species – *Vipera sarmatica* – are registered in the NMNHU-P collection (NMNHU-P AR-627/1-25). These fossils come from Bessarabian (Late Miocene) deposits near the village of Kalfa (Republic of Moldova). It is too early to assess about a definite loss of the type specimens of *Daboia ukrainica* and *Vipera meotica*. These materials may be in scientific institutions of Moldova, Georgia, or Czech Republic with which Galina Zerova closely cooperated. It would be great to establish cooperation with these institutions and perhaps even return the lost types back to the National Museum of Natural History, National Academy of Sciences of Ukraine.

[Talk] [non-student]

Feasting and death: microwear and cementochronological analyses of cave bear (*Ursus spelaeus*) teeth from Ciemna Cave, southern Poland

Nina Kowalik[1,*], Sylwia Pospuła[1], Iván Ramírez-Pedraza[2,3], Florent Rivals[2,3,4], Oliwia Oszczepalińska[1], Katarzyna Zarzecka-Szubińska[5], Damian Stefański[6] & Paweł Valde-Novak[7]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA), Tarragona. Spain;

[3] Universitat Rovira i Virgili, Departament d'Història i Història de l'Art, Tarragona. Spain;

[4] Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain;

[5] Department of Palaeozoology, Wrocław University, Wrocław, Poland;

[6] Archaeological Museum of Kraków, Kraków, Poland;

[7] Institute of Archaeology, Jagiellonian University, Kraków, Poland;

[*] kowalik@isez.pan.krakow.pl – presenting author

Keywords: Cave bear, diet, season of death, microwear, teeth.

This investigation examines two aspects of the ecology of the cave bear (*Ursus spelaeus*): the season of death and dietary habits. The study material originates from one of the most extensively researched sites in the Kraków-Częstochowa Upland (southern Poland), i.e., Ciemna Cave. This region is renowned for its rich record of cave bear remains, suggesting it constituted a suitable ecological niche for this large mammal. Carnivore remains are the most numerous among the palaeontological materials excavated at the site, with the cave bear being the dominant species, represented by the highest number of individuals. The study focuses on first lower molar teeth recovered from stratigraphic layers dated from Marine Isotope Stage (MIS) 5 to 2. This temporal range allows for the investigation of changes in various ecological aspects of the cave bear over time. Cementum layer analysis was employed to test the hypothesis that some individuals may have died during hibernation. Light cementum layers form during periods of high food availability (summer), while dark layers are deposited during

times of food scarcity or hibernation (winter). Microscopic examination of cementum lamination revealed between two and thirteen layers, consistent with crown wear stages. Although some samples were affected by diagenesis, the presence of prominent lamination suggests that death occurred after the end of the vegetative season or during hibernation. Microwear analysis, a technique used to reconstruct an animal's diet in the final weeks - or even days - prior to death (the so-called "last supper effect"), indicates a primarily plant-based diet in bears ages MIS 5 to MIS 3. Additionally, two MIS 5 specimens exhibit microwear patterns consistent with the consumption of hard foods such as seeds or fruits. In contrast, the youngest specimen, dating to MIS 2, shows a distinct dietary pattern with a lower number of scratches, suggesting a lower consumption of grasses and a higher consumption of vertebrates, probably related to less favourable environmental conditions.

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[Talk] [non-student]

Xenarthrans in Pleistocene megafauna - a new hypothesis for the origin of neomorphic ossification in glyptodonts

Kévin Le Verger[1,*] & Marcelo R. Sánchez-Villagra[1]

[1] Department of Paleontology, University of Zurich, Zurich, Switzerland;

[*] kevin.leverger@pim.uzh.ch – presenting author

Keywords: Glyptodontidae, Pleistocene, climate, endocranium, neomorphic ossification.

Xenarthra is one of the four major placental clades and include armadillos, anteaters and sloths. Their modern meagre diversity is a fragment of the great past diversity that forms their evolutionary history. The study of this clade, endemic to South America and isolated for about 30 million years, provides an opportunity to investigate diversity patterns and morphology as influenced by various biotic and abiotic factors, such as gigantism or the impact of humans. One of the largest collections of xenarthrans in Europe belongs to the Santiago Roth collection at the University of Zurich, which includes many specimens of Pleistocene species from the Pampean region of Argentina. The recent re-examination of the material in this collection has led to published works and pieces of research that are nearing completion. A taxonomic reassessment first enabled us to highlight that the high diversity of xenarthrans in this region fluctuated between biomes associated with a warm, humid environment and a colder, more arid environment, following the cyclical cooling that occurred during the Pleistocene. From the cold, arid biome, an exceptionally well-preserved skull of a glyptodont displayed an odd face due to ossification of nasal cartilage, a synapomorphy of Neosclerocalyptini. Previous studies have suggested that this neomorphic ossification may correspond to an adaptation to a colder, more arid climate, linking the ossification of the nasal cartilage with nasal cavity functions, including improved airflow and better hydric and thermal regulation. However, the only study that has explored this relationship in detail has focused on the youngest species in the clade. The specimen in Santiago Roth's collection corresponds to the oldest Pleistocene species, allowing us to test whether the neomorphic ossification is in contact with the nasal cavity, and thus

potentially with climate changes. Using X-ray microtomography, we explored the endocranial anatomy of this specimen and revealed that the cavities formed by the neomorphic ossification do not meet the nasal cavity, thus rejecting the climato-anatomical hypothesis. We suggest that the appearance of this neomorphic ossification is more likely to be associated with the anterior development of the cephalic shield serving as structural support in the earliest clade representatives. The ossified nasal cartilage would then have derived to serve the functions of the nasal cavity by exaptation. The neomorphic ossification of *Neosclerocalyptus* is unique and extreme within the animal kingdom, providing further evidence of the unusual anatomy of xenarthrans within mammals.

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[Talk] [student]

Analyses of hydrodynamic optimality on heterostracans contest the ecospace saturation hypothesis during early vertebrate evolution

Elsa Leflaëc[1,*], Antonio Ballell Mayoral[2], Oscar Sanisidro[3] & Humberto G. Ferrón[1,2]

[1] Instituto Cavanilles de Biodiversidad I Biologia Evolutiva, Valencia, Spain;

[2] University of Bristol, Bristol, United Kingdom;

[3] Universidad de Alcalá, Alcalá de Henares, Spain;

[*] elsa.leflaec@uv.es – presenting author

Keywords: Heterostraci, 3D geometric morphometrics, Computational Fluid Dynamics.

Vertebrates, which are one of the most diversified groups of today's ecosystems, are currently dominated by jawed animals (gnathostomes). In the Silurian, however, jawless vertebrates (agnathans) dominated the world's oceans, before their hegemony declined in the Devonian in favor of gnathostomes. Many hypotheses exist to explain this important evolutionary process, such as an increase in predation, a loss or displacement of habitat, or the ostracoderms having explored all the possible morphological variation achievable with their body plan, which suggests that jawless vertebrates reached an ecological dead end, being limited by their body plans, while key innovations in jawed vertebrates eliminated such constraints. Nevertheless, the lack of relevant extant analogues of agnathans has made it difficult to study and therefore understand this transition. We tested the latter hypothesis by examining headshield shape and hydrodynamics in heterostracans (the most diverse clade of jawless-fishes) using the three-dimensional geometric morphometrics and computational fluid dynamics. The reconstruction of hydrodynamic trade-offs and optimality landscapes showed that early-diverging species occupied less optimal regions of the morphospace, while later lineages showed a trend toward greater hydrodynamic efficiency. However, despite developmental and phylogenetic constraints, the most hydrodynamically efficient morphologies remained unexplored throughout the group's evolutionary history. These findings question the hypothesis of ecospace saturation and propose that heterostracans went extinct before fully exploring potentially optimal headshield morphologies. The study introduces new questions around the extinction factors that hindered the evolutionary path of this ecologically innovative group.

[Poster] [non-student]

The Magdalenian culture site in the Tatra Mountains - preliminary results of vertebrate remains from the Hučivá Cave

Anna Lemanik[1,*], Krzysztof Wertz[1], Katarzyna Zarzecka-Szubińska[2], Georgios L. Georgalis[1], Grzegorz Lipecki[1], Andrea Pereswiet-Soltan[1], Sylwia Pospuła[1], Magda Kowal[3], Anna Kraszewska[3], Jakub Skłucki[3], Marian Sojak[4], Paweł Valde-Nowak[3] & Adam Nadachowski[1]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Department of Palaeozoology, University of Wrocław, Wrocław, Poland;

[3] Institute of Archaeology, Jagiellonian University, Kraków, Poland;

[4] Institute of Archaeology, Slovak Academy of Sciences, Bratislava, Slovakia;

[*] lemanik@isez.pan.krakow.pl – presenting author

Keywords: Late Pleistocene, taphonomy, palaeoecology, mammals, birds.

Hučivá Cave (49°13′14.8″N, 20°18′37.2″E) is located in the Belianske Tatras, Slovakia. During the excavations, six main layers of sediments differing lithologically were distinguished. Radiocarbon dates made from coals from the hearth identified in layer 6 indicate its formation from ca. 14.119±132 to 14.055±116 Ka. Numerous archaeological artefacts indicative of the Magdalenian culture were discovered in the site.

Most of the remains of both large and small vertebrates came from layers 5 and 6. Among the ungulates, the remains of the *Capra ibex* were the most numerous and dominated almost all layers. The remains of *Equus ferus* were less numerous. *Rupicapra rupicapra*, *Cervus elaphus*, and *Bison priscus* were also identified and were represented by single specimens. Among the carnivores, the remains of the *Ursus arctos* predominated. *Vulpes vulpes*, *Lynx lynx*, and Mustelidae were also found. *Capra ibex* is a mountain species that at present lives in the Alps, currently does not occur in the Tatra Mountains. The presence of 12 rodents, 17 bats and five "insectivore" (eulipotyphlan) taxa were found, but their remains were few. The species most numerously represented were *Microtus arvalis* and *Clethrionomys glareolus*. Both species are

currently found in Slovakia. *Stenocranius anglicus* is characteristic of Pleistocene rodent assemblages and does not occur today in Slovakia. The rodent fauna included two species present in mountainous areas *Marmota marmota* and *Chionomys nivalis*. Interesting is the presence in the cave of the bat species *Rhinolophus hipposideros* and *Pipistrellus pipistrellus*, which are rare in caves of this region. Among amphibians, the remains of *Salamandra salamandra* dominated the assemblage. A very few vertebral remains of a snake of the colubrid genus *Coronella* were also found. The most represented bird species in the assemblage are *Lagopus lagopus* and *Lagopus muta*. Other bird species identified include larger galliforms such as *Tetrao urogallus* and *Lyrurus tetrix*, as well as passerine birds, primarily *Pyrrhocorax graculus*, thrushes, and swallows. Singular bones of three owl species *Bubo scandiacus*, *Bubo bubo*, and *Asio flammeus* were found, along with remains of some waterbirds, e.g., *Calidris pugnax*, *Clangula hyemalis*, cf. *Cygnus columbianus*, and *Cygnus cygnus*. Some bird species identified do not occur in the Tatra Mountains nowadays and are indicating tundra or boreal environment. Preliminary taphonomy results demonstrate human traces of carcass processing are present on the big mammal and bird remains. Cutting marks, traces of bone breaking, and bone artefacts were also found.

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[Poster] [non-student]

Herpetofauna from La Bouffie (Quercy, Lot, Southwestern France): insights into the diversity of a late Eocene (MP 17A) world

Alfred Lemierre[1,*] & Georgios L. Georgalis[2]

[1] Royal Tyrrell Museum of Palaeontology, Drumheller, Alberta, Canada;

[2] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[*] alfred.lemierre@gov.ab.ca – presenting author

Keywords: Herpetofauna, Quercy Phosphorites, Squamata, Glyptosauridae, Lissamphibia.

The Quercy Phosphorites area, in Southwestern France, provides more than 200 fossiliferous localities ranging from the early Eocene to the Early Miocene. They document a diverse continental fauna and its evolution throughout more than 30 million years, including a massive turnover in vertebrates around the Eocene–Oligocene transition, dubbed the Grande Coupure. Among the Quercy localities, the locality of La Bouffie, dated from the early late Eocene (MP 17A) has been known to have yielded a diverse herpetofauna, including rare taxa in Europe (e.g., Tupinambinae). Unfortunately, most of the herpetofauna has never been described nor illustrated, leaving uncertainties regarding its true diversity. We present here our study on "forgotten" and undescribed specimens from La Bouffie, pertaining to anurans, an urodele, and gekkotan, lacertid, amphisbaenian, pleurodontan, glyptosaurid, anguine, and palaeovaranid lizards. Among them, five taxa are identified for the first in La Bouffie, including two new taxa: a new genus and species of pleurodontan and a new genus and species of glyptosaurine. The new pleurodontan represents the fourth genus of that group from the late Eocene of Europe, highlighting the diversity of this clade prior to its European decline during the Grande Coupure. The new glyptosaurine glyptosaurid taxon represents the second late Eocene glyptosaurine from the late Eocene of Europe, suggesting a higher diversity for this Holarctic group in the

continent. Based on our study and a review of the described herpetofauna from La Bouffie, we identify at least 18 formally described taxa, while eight others need to be properly reassessed, as they have only been briefly mentioned. Thus, with 18 to 26 taxa, La Bouffie has yielded one of the most diverse herpetofaunas from the late Eocene of Europe, highlighting the diversity of this often-overlooked component of the fauna.

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[Talk] [non-student]

The unexpected 2006 remaster: The lengths we go to, to pull a *Leedsichthys* size estimate from the fragments of oblivion

Jeff Liston[1,*]

[1] Department of Earth Sciences, Faculty of Geosciences, Utrecht University, Utrecht, the Netherlands;

[*] leedsichthys@gmail.com – presenting author

Keywords: Pachycormiformes, Pachycormidae, size estimation, palaeoart, scientific outreach.

Reconstructing extinct vertebrates is at the core of what we do within our science, usually entailing work with a palaeoartist to facilitate the communication of our understanding of the animal in question, often driven by museums and their need for displayable content as a conduit for scientific research. This process usually challenges both this understanding and our shared preconceptions, in order to justify the representation that we end up communicating to the 4th and 5th estates of media and social media for traction with the press releases of our scientific work. The more fragmentary the evidence, the more work that is necessary to try to build this representation, and few have been as challenging as the marine bony fish *Leedsichthys*. Despite more than 70 individuals having been excavated over the last 150 years, this actinopterygian taxon has remained hard to constrain even in terms of its dimensions, due to its poor and patchy ossification, which renders major parts of the skeleton either absent or highly fragmentary. The first scientifically constrained approach to this problem was produced in a 2006 thesis, using a partial matrix of five of the most complete specimens and relating the sizes of three individual bony elements (ceratohyal, hyomandibula, preopercle) to rates of growth, age and standard length estimation. Further preparatory work was subsequently undertaken on one of the final five key specimens a decade later, informing the first ever skeletal reconstruction of the full animal and resulting in a change in the matrix architecture. This revised matrix formed the

structural basis for the speculative creation of a juvenile *Leedsichthys* two years ago for the newly-opened Dubai Museum displays.

Last year, the Westfälisches Landesmuseum in Münster, northern Germany, asked for input for a reconstruction based on the specimen they hold from the Wiehen Mountains. As this specimen possessed no bones in common with those used in the original matrix, an entirely new bony element had to be added to a remastered version of the matrix. For this situation, the best bone to use – i.e., the one with the widest representation among the hypodigm of all *Leedsichthys* specimens - was the hypobranchial, a bone notoriously misidentified as an isolated stegosaur tail spine amidst a pile of fish bones when the specimen was originally discovered and described in Wiehen. This experience demonstrates how a museum mission of outreach can drive scientific understanding of the extinct vertebrates that we work upon.

[Poster] [non-student]

Preserving the Sacral Timeline?: Enigmatic bone remains enigmatic

Femke M. Holwerda[1] & **Jeff Liston**[1,*]

[1] Earth Sciences, Utrecht University, Utrecht, The Netherlands;
* leedsichthys@gmail.com – presenting author

Keywords: Middle Jurassic, Callovian, Oxford Clay, dinosaurs, marine reptiles.

Shallow marine environments can be problematic sources of vertebrate remains in terms of their identification. They have the potential to draw on terrestrial as well as riparian and marine ecosystems as sources for their fossil material. This can challenge the expertise of those attempting to identify these remains, requiring a generalist knowledge of a wide range of osteological components across diverse taxa. Such a complex sedimentary resource is the Middle Jurassic (Callovian, ~150 Ma) Oxford Clay of Peterborough, England, UK. The Peterborough Oxford Clay has been the source of partial and isolated remains of a wide range of dinosaurs for almost 150 years, as well as the occasional pterosaur bone, in addition to the rich marine reptile ecosystem that it is globally known for. Although the fragmentary nature of these terrestrial remains prohibits a clear view of the species richness represented, the high level taxonomy that it indicates has been shown to be directly equivalent in diversity to the slightly younger Kimmeridgian–Tithonian faunas of both Tendaguru (Tanzania) and the Morrison Formation (USA). However, it can be more difficult to determine identities and - as an example of the taxonomic confusion that can result from an isolated bone - one may consider the large actinopterygian *Leedsichthys*, a bony fish whose skull roof remains were first identified as armour of a stegosaurian dinosaur. Since then, components of its poorly-preserved skeleton have been misidentified as belonging to - amongst others - sauropod dinosaurs, pterosaurs, thyreophoran dinosaur tail spines, with its fins being mistaken for calcareous algae and reeds. Such confounding isolated osteological components continue to emerge from the Oxford Clay, and one such is presented here in virtual form for your delectation in an interactive poster display. Roughly 25 cm across, this single bone has been passed around a number of experts in Oxford Clay remains, but despite its large size, which one might expect would significantly constrain candidates for its possible owners, the range of suggested identifications – basisphenoid, sacral vertebra, opisthotic – have remained tentative and inconclusive. As such, provisional identifications are welcomed – as are #wronganswersonly.

[Poster] [non-student]

Keeping your Tinder wet: palaeopathology sheds light on predatory left-swiping behaviour in the Niobrara Formation, USA

Anthony E. Maltese[1] & **Jeff Liston**[2,*]

[1] Rocky Mountain Dinosaur Resource Center, Woodland Park, Colorado, United States;
[2] Earth Sciences, Utrecht University, Utrecht, The Netherlands;
[*] leedsichthys@gmail.com – presenting author

Keywords: Palaeopathology, caudal lobe, Ichthyodectidae, *Protosphyraena*, callus growth.

Palaeopathology, as the study of ancient injuries and diseases, examines anomalies in the development of fossilised tissues. Vertebrate injuries recording predation predominantly relate to bites, but other forms of attack can be preserved. We report on an actinopterygian tail specimen from the Coniacian of the Niobrara Formation in Kansas, USA, that exhibits unusual patterns of damage and subsequent repair, with breaks only occurring on one side of a caudal lobe. The specimen consists of an articulated ichthyodectid caudal peduncle consisting of seven vertebrae preserved with haemals and neurals that allow orientation to be established, together with a partial fin, the distal portions of each lobe having been lost to erosion. Of the possible candidate taxa in the Western Interior Seaway (WIS), morphology and stratigraphy are consistent with and constrain diagnosis to *Gillicus*, *Ichthyodectes* or a small *Xiphactinus*. The left side of the upper lobe of this caudal fin preserves an area where the caudal rays are completely severed in a line. The initial injury does not appear to have penetrated the midline to affect the right fin rays. Extensive remodeling of the severed ends of the bones gives each a bulbous appearance, although they show no indication of having fully healed back together. The right rays, possibly acting as a splint to stabilise the wounded tail, exhibit a slight thickening of the rays in the area opposite the pathology, possibly as a result of increased stress on that area while swimming. Many possible predators are known from the WIS, but the nature of the wound as a lateral slash on only one side and the lack of any foreign material or teeth lodged in the middle of the fin appears to preclude the possibility of

it being the result of a bite from mosasaurs, sharks, or most bony fish. The location of the wound on the upper lobe of a pelagic fish makes it unlikely to have resulted from impact damage from the terrain. The pursuit predator *Protosphyraena* is, however, commonly found in these sediments and the nature of the trauma is consistent with a slashing attack by this animal's lance-like rostrum during active hunting, similar to some contemporary istiophorids. Such evidence of an attack, representing an attempt to disable its prey's ability to escape through the primary propulsion of its tail, is unique in the fossil record and shows that the Niobrara Chalk still yields striking specimens enhancing understanding of the WIS ecosystem.

[Talk] [non-student]

Phylogenetic analysis of stem archosaurs revealing the hidden diversity of Triassic trachelosaurids (Archosauromorpha, Tanysauria)

Jun Liu[1,*], Yu-Ting Lu[1], Yi-Wei Hu[1], Qiang Li[1] & Xing-Yu Shen[1]

Division of Geology, School of Resources and Environmental Engineering, Hefei University of Technology, Hefei, China;

[*] junliu@hfut.edu.cn – presenting author

Keywords: Trachelosauridae, South China, phylogeny, taxonomy, marine reptiles.

Due to their position in the upper trophic level of the Triassic ecosystems, the diversity of reptiles is important for understanding the timing and pattern of biotic recovery after the Permo-Triassic mass extinction. The Tanysauria, a group of stem archosaurs characterised by elongated cervical vertebrae, ribs, and low cervical neural spines, is one of such predators that roamed both on land and in the sea during the Triassic. There is ongoing controversy about both the phylogeny of Tanysauria and its relationships to other stem archosaurs. Recently discovered fossils from South China offer new insights that may help resolve these debates. During the period when the 1:50,000 scale geological mapping was conducted in the Luxi County, Yunnan Province, South China a decade ago, a new intraplatform basin from the Upper Member of Guanling Formation (Pelsonian, Anisian, Middle Triassic) was recognised, with a very diverse fossil assemblage preserved in the basin. In particular, thousands of articulated reptile specimens have since been discovered in this basin, among which several new taxa have been formally named, including one belonging to Tanysauria. Here, we describe another new taxon of Tanysauria from this basin. Our phylogenetic analysis, based on a novel data matrix, clearly supports the classification of the new taxon as a trachelosaurid. Notably, our phylogenetic analysis recovered *Tanystropheus antiquus*, a well-known but controversial taxon, as a member of the Trachelosauridae, extending the known time range of this family to the Early Triassic

(latest Olenekian). In addition, the two Chinese tanysaurs, *Gracilicollum latens* and *Augustaburiania vatagini*, were recovered as members of Trachelosauridae, significantly increasing the diversity of this family. These results suggest that the Trachelosauridae possessed more ecomorphological diversity than previously thought and exhibited diverse habitat preferences during the early Middle Triassic in southwestern China.

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[Poster] [student]

A diverse snake fauna from the Plio-Pleistocene of Athens, Greece

Olaf Lizak[1,*], Massimo Delfino[2,3] & Georgios L. Georgalis[1]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Dipartimento di Scienze della Terra, Università di Torino, Turin, Italy;

[3] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Edifici ICTA-ICP, Barcelona, Spain;

[*] lizak@isez.pan.krakow.pl – presenting author

Keywords: Serpentes, taxonomy, Pliocene, Pleistocene.

Greece is currently home to a variety of snake lineages, being represented by members of Typhlopidae, Erycidae, Colubridae, Natricidae, Psammophiidae, and Viperidae. Here, we present the Plio-Pleistocene snake fauna from the Tourkobounia fossil localities. Tourkobounia (also known as Lykobounia or Anchesmos) is a high and broad hill range in Athens and its five fossil sites range from the Late Pliocene up to the Middle Pleistocene and have yielded a diverse snake fauna, which has remained so far only poorly documented or simply mentioned in the literature. Interestingly, the fossil snake material from the Tourkobounia sites spans major climatic transitions and offers valuable insights into both taxonomic diversity and biogeographic dynamics in the region over time. The Late Pliocene site of Tourkobounia 1 (MN 16) yielded specimens of Scolecophidia indet., *Eryx* sp., cf. *Malpolon* sp., *Naja* sp., representatives of both the large "Oriental vipers" and smaller "European vipers", as well as indeterminate Colubriformes. This assemblage reflects a snake fauna much different from that of the modern Athens area. The presence of the cobra *Naja*, a genus now absent from the European continent, highlights past climatic differences. The viper material includes one of the largest known fossil representatives of the "Oriental vipers", whose modern counterparts have experienced substantial range reductions in favor of "European vipers". In contrast, the Middle Pleistocene sites of Tourkobounia 2–5 yielded taxa more similar to the present-day fauna:

Scolecophidia indet., cf. *Coronella* sp., *Elaphe quatuorlineata*, *Zamenis longissimus*, cf. *Zamenis situla*, indeterminate Colubridae, cf. *Natrix tessellata*, *Natrix* sp., cf. *Vipera ammodytes*, *Vipera* sp., as well as indeterminate Colubriformes. While this assemblage more closely resembles the modern snake fauna that currently inhabits the area of Athens, it also reveals biogeographic changes: notably, both *Zamenis longissimus* and the genus *Coronella* are no longer found in the region today. Together, these fossil assemblages document shifts in species composition and geographic distribution in the Athens region over the past few million years. Tourkobounia 1 reflects a warm-climate fauna with taxa now locally extirpated, whereas Tourkobounia 2–5 indicate the persistence of modern lineages, even with slightly altered geographic ranges.

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[Talk] [student]

Scratching the surface: preliminary results of TDMA (Total Dental Microwear Analysis) to discriminate ecological groups in extant and fossil canids (Carnivora, Canidae)

Cecilia Loddi[1,*], Andrea Faggi[1], Saverio Bartolini Lucenti[1, 2] & Lorenzo Rook[1]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;

[2] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain;

[*] cecilia.loddi@unifi.it – presenting author

Keywords: Caninae, dental microwear, palaeoecology, Pleistocene.

The aim of this study is to discriminate the ecological groups of extant and fossil Caninae species using different approaches of dental microwear analysis. Although this proxy has been widely applied on herbivores, there is still lot to investigate about the relationships between different diet and the relative patterns of dental microwear inside the Order Carnivora. To have a clearer understanding of this innovative approach in the palaeoecological reconstructions of fossil carnivores, this study binds together the two main methodologies commonly used: the quantitative DMA (Dental Microwear Analysis) and the qualitative DMTA (Dental Microwear Texture Analysis). Focus of this study is the Subfamily Caninae that includes extant and fossil species characterized by a range of ecological adaptations that vary from hypocarnivory to hypercarnivory. In order to characterize the different patterns of microwear associated with the ecological groups in which this subfamily is usually divided into, the dental microwear of the lower first molar has been analysed. Worn surfaces of the shearing portion of the tooth (trigonid) and the crushing portion (talonid) were analysed separately to find any difference since the role of these two parts is different during the mastication. The dataset is composed of species of the extant Caninae with a variable percentage of meat consumed, thus ranging from hypocarnivores to hypercarnivores. Two fossil taxa with plausible different ecology were included in the

analysis: *Canis lupus maximus* from the Jaurens Cave, France (Late Pleistocene; 31 Ka) adapted to the cold environment of MIS 3, and *Canis mosbachensis* from Cueva Victoria, Spain (latest Early Pleistocene) considered to have hypercarnivorous adaptations. The results of this study demonstrate that the difference in terms of dental microwear pattern is evident between hypercarnivores and meso/hypocarnivores, especially observing the crushing surfaces of the lower m1. *Canis lupus* from Jaurens Cave differs from the extant grey wolf in its diet composition, consuming less meat and harder food items, probably as adaptation to cold environments. On the other hand, diet composition of *Canis mosbachensis*, which is still unclear, seems to be similar to mesocarnivore extant Caninae. These promising results show that the TDMA can be a highly promising tool to characterize the palaeoecology of fossil carnivores.

[Poster] [student]

Ciao, *Anancus*! New dental material of a tetralophodont gomphothere (Mammalia, Proboscidea) takes its bite into Italy's latest Miocene / Early Pliocene fossil record

Priscila Lohmann[1,*], Dimila Mothé[2,3] & Luca Pandolfi[4]

[1] Department of Earth Sciences, NOVA School of Science and Technology, Caparica, Portugal;
[2] Grupo de Estudos em Megafauna, Department of Zoology, Federal University of the State of Rio de Janeiro, Rio de Janeiro, Brazil;
[3] Programa de Pós-graduação em Biodiversidade Neotropical, Federal University of the State of Rio de Janeiro, Rio de Janeiro, Brazil;
[4] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;
[*] lohmann.priscila@gmail.com – presenting author

Keywords: Neogene, Gomphotheriidae, taxonomy, dental morphology, historical collection.

Fossil remains of *Anancus* have been discovered across Europe and large parts of Asia and Africa, indicating a wide geographic distribution from the Late Miocene to Early Pleistocene (~7.2 to 2 Ma). The molars of *Anancus* exhibit anancoidy (alternating arrangement of labial and lingual cusps), a simple to complex morphology (with few accessory conules), and thick enamel. This study describes nine *Anancus* specimens from the Early Pliocene of Italy, housed in the palaeontological collection of the Natural History Museum at the Accademia dei Fisiocritici, in Siena, since 1762. The sample comprises dental remains, including molars and two partial mandibles, from Montefollonico, Torrita di Siena, Siena province. The area surrounding the locality is characterized by Early Pliocene marine deposits with a sporadic record of continental or transitional facies. The specimens were measured, photographed, morphologically described, and compared to the diagnoses of *Anancus* species in the literature. The mandibular specimens are fragmented. All molars were identified as bunodont, with the first and second molars being tetralophodont and the third molars pentalophodont (4 and 5 lophs/lophids + small posterior cingulum). The occlusal morphology is simple, with accessory cusps and conules nearly absent in the valleys, weak anancoidy, thick, unfolded enamel. Based

on these diagnostic features, we identify the remains as a less derived form of *Anancus*, exhibiting the simplest and primitive dental traits among European *Anancus* species. This study reports the first certain occurrence of a “primitive” form of *Anancus* in Italy, suggesting a critical revision of latest Miocene and earliest Pliocene records assigned as Arvenian gomphothere. This discovery contributes to the understanding of gomphothere diversity and dispersal in latest Miocene and Early Pliocene in Europe.

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[Talk] [student]

Hidden clues in phytosaur lower jaws – phylogenetic significance on the post-dentary mandible bones

Víctor López-Rojas[1,2,*], Miguel Moreno-Azanza[1,2,3] & Eduardo Puértolas-Pascual[1,2,3]

[1]GeoBioTec, Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa, Monte de Caparica, Portugal;
[2]Museu da Lourinhã, Lourinhã, Portugal;
[3]Aragosaurus–IUCA Recursos Geológicos y Paleoambientes, Universidad de Zaragoza, Zaragoza, Spain;
* v.rojas@campus.fct.unl.pt – presenting author

Keywords: Phytosauria, post-dentary, Triassic, phylogeny, geometric morphometrics.

Phytosaurs, crocodile-like archosauriforms from the Late Triassic, are well-known since the early 19th century for their bizarre skull morphology. On the other hand, their mandibles and post-cranial fossil remains have received little attention in palaeontological research. Here we applied 2D Geometric Morphometrics (GM) for the first time in the posterior portion of the dentary region of 20 phytosaur mandibles, with the intention of identifying and quantifying the potential morphological differences from this region. This technique revealed informative phylogenetic signals within the mandibular morphology. It allowed us to update the latest datasets with the modification of two previously described mandible characters and the proposal of four new ones. Notably, some of these characters have even been identified as synapomorphic features for the Leptosuchomorpha clade. To further test the utility of these new characters, we created a second dataset including two specimens with difficult taxonomic resolution. An isolated right mandible specimen from South Portugal (Silves Formation, Carnian), and a previously studied Mystriosuchini specimen from New Mexico (Bull Canyon Formation, late Norian). The analysis helped resolve the phylogenetic placement and relationships of these two phytosaur specimens. In the case of the Portuguese phytosaur, this shows a close relationship with Moroccan phytosaurs, while the North American specimen

showed a closer relationship with *Machaeroprosopus*, a genus otherwise known from the late Norian of USA (Utah, New Mexico, California, and Texas). These results are consistent with the known fossil record of the localities where the specimens were collected.

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[Poster] [non-student]

New ape material (Primates, Hominoidea) from the Middle Miocene of Silesia, Poland

Sergi López-Torres[1,*], Marcin Górka[2], Adrian Marciszak[3], Yohan Pochat-Cottilloux[1], Paweł Socha[3], Krzysztof Stefaniak[3] & Mateusz Tałanda[1]

[1] Faculty of Biology, University of Warsaw, Warsaw, Poland;
[2] Faculty of Geology, University of Warsaw, Warsaw, Poland;
[3] Faculty of Biological Sciences, University of Wrocław, Wrocław, Poland;
[*] s.lopez-torres@uw.edu.pl – presenting author

Keywords: Miocene, Primates, Poland, Dryopithecinae, Opole.

The non-human primate fossil record of Poland is extremely limited. The only remains known, a few isolated teeth, have been ascribed to the genus *Pliopithecus*, a stem catarrhine primate (i.e., the group that includes Afroeurasian monkeys and apes) from the Middle Miocene. The Polish record of *Pliopithecus* originates from two sites in Silesia, in southwestern Poland, specifically Przeworno and Opole. Pliopithecoids are well documented in the Miocene of western and southern Europe, as well as other large primates, like hominoids (i.e., apes). However, Miocene hominoid fossils have never been reported from northeastern Europe, which would represent, at the time, the northern shore of Central Paratethys.

Here we present new hominoid material from the site of Opole 2 (MN 7–8, Middle Miocene) in Silesia, representing the lower third molar of a member of Dryopithecinae. The molar is well preserved and completely unworn. Whereas the Opole M_3 does show some degree of distal tapering, it is not as strong as seen in *Rudapithecus*, a dryopithecine from nearby Hungary but from a younger age (MN 9). The Opole M_3 has a practically absent buccal cingulum, with only an incipient shelf on the mesiobuccal aspect of the tooth. No apparent tuberculum sextum is visible between the entoconid and the hypoconulid, which is distally placed. The hypoconid appears as a strong and robust cusp.

In sum, the Opole dryopithecine shows features present in other European members of this group but differs from geographically closer apes. Additionally, the presence of apes in the northern shore of the Parathetys opens to the door alternative routes of dispersal across Eurasia during the Middle Miocene.

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[Talk] [non-student]

New lorisoids (Primates, Strepsirrhini) from the Late Miocene Lemudong'o Formation, southern Kenya

Sergi López-Torres[1,*], Deming Yang[2,3], Fredrick Kyalo Manthi[4] & Ashley S. Hammond[2,3]

[1] Faculty of Biology, University of Warsaw, Warsaw, Poland;

[2] Division of Anthropology, American Museum of Natural History, New York, New York, USA;

[3] New York Consortium in Evolutionary Primatology, New York, New York, USA;

[4] Department of Earth Sciences, National Museums of Kenya, Nairobi, Kenya;

[*] s.lopez-torres@uw.edu.pl – presenting author

Keywords: Miocene, Primates, Kenya, Lorisidae, Galagidae.

The African Miocene fossil record of strepsirrhines (lemurs, lorises, and bushbabies) is relatively poor. In the Miocene of continental Africa, strepsirrhines are represented by two families: Lorisidae and Galagidae (together forming the superfamily Lorisoidea). Lorisids are slow-moving, insectivorous strepsirrhines with a scarce fossil record. The oldest Miocene lorisid, *Mioeuoticus*, comes from the Early Miocene of Kenya and Uganda. Younger records are rare and lack generic ascription. Contrarily, the galagid fossil record is richer. Galagids are fast-moving leaping arborealists that also feed on insects. The galagid Miocene record is represented by the genera *Progalago* (Early Miocene, Kenya and Uganda), *Komba* (Early and Middle Miocene, Kenya and Uganda), and the extant *Galago* (Late Miocene, Egypt). Pliocene galagids are also known.

Here we present new strepsirrhine materials from the Lemudong'o Formation (Late Miocene, ~6 Ma) in southern Kenya, representing a lorisid and a galagid. The lorisid specimen consists of a fragmentary left maxilla that includes both an M^2 and M^3, preserving the zygomatic process. The Lemudong'o lorisid has a more derived morphology than the Early Miocene *Mioeuoticus* (i.e., mesiodistally shorter molars, lingually tapering M_2, reduced M_3). The Lemudong'o lorisid appears to be intermediate between *Mioeuoticus* and modern pottos (*Perodicticus*) and angwantibos (*Arctocebus*); i.e., straight distal aspect of M_2. However, it

differs from *Mioeuoticus* and modern African lorisids in having a very reduced M_2 hypocone. The wear patterns observed in its molars are more consistent with a folivorous diet, which is not seen in modern lorisids.

The galagid specimen is represented by a right mandibular fragment with P_2-M_1 + M_3 in place, and the alveoli of I_1-C_1 + M_2. The Lemudong'o galagid differs from all known galagids by the peculiar morphology of the P_4, which is less molarized than in other galagids, both fossil and modern. The Lemudong'o galagid is a fairly robust and large bushbaby (i.e., deep mandible, mesiodistally long mandibular symphysis), although short-faced due to its short premolar row. However, its molar morphology is like those of more gracile, smaller galagids (i.e., pointy, non-inflated cusps).

In sum, the Late Miocene lorisoids show mosaic characteristics between older Miocene representatives and modern species, suggesting that they likely belong to novel taxa. These new findings shed light on the poorly known Late Miocene strepsirrhine diversity in Africa.

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[Talk] [non-student]

Batrachosauroidid, amphiumid, and sirenid salamanders (Urodela): an example of greenhouse-driven convergent morphology

Loredana Macaluso[1,2,*], Ane Elise Schrøder[3,4], Jonathon Leonard[5], Hendrik Müller[1], Davit Vasilyan[6], Márton Rabi[7], Philip B. Holden[8], Sabin Zahirovic[5] & Roberto Rozzi[1,9]

[1] Natural Science Collections, Martin Luther University Halle-Wittenberg, Halle (Saale), Germany;
[2] Museo Regionale di Scienze Naturali, Turin, Italy;
[3] Department of Geosciences and Natural Resource Management, University of Copenhagen, Copenhagen, Denmark;
[4] Dipartimento di Scienze della Terra, Università degli Studi di Torino, Turin, Italy;
[5] School of Geosciences, The University of Sydney, Sydney, Australia;
[6] JURASSICA Museum, Porrentruy, Switzerland;
[7] Fachbereich Geowissenschaften der Eberhard Karls University Tübingen, Tübingen, Germany;
[8] Environment, Earth and Ecosystem Sciences, The Open University, Milton Keynes, United Kingdom;
[9] Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[*] macalusoloredana@gmail.com – presenting author

Keywords: Everglades, Late Cretaceous, benchtop μXRF-element mapping, limb reduction, climate change.

As we dangerously approach to a human-induced greenhouse world, the cascading effects that climate change can have in reshaping ecosystems are complex and challenging to predict, but the evolution of past ecosystems and their reaction to sudden climate change can shed light on past examples. Salamander biodiversity has undergone major modifications since the Paleogene period, from obligate paedomorphic forms largely dominating the Late Cretaceous–Paleogene ecosystems to facultative paedomorphic or biphasic species during Neogene and present-day.

The most abundant family of pre-Eocene crown-salamanders, Batrachosauroididae, is herein for the first time included in a comprehensive phylogeny, through the study of more than 250 specimens of the middle Eocene batrachosauroidid *Palaeoproteus klatti* from the Geiseltal Lagerstätte (Sachsen-Anhalt, Germany). The newly recovered phylogenetic position of the group and results of non-destructive benchtop μXRF-element mapping, herein used for the first time on an amphibian, highlighted a strong convergence in both body plan and diet of the extinct batrachosauroidids and the extant families Amphiumidae and Sirenidae, which inhabit the south-east of North America. Not only do these three groups retain obligate paedomorphy, but they also share a strong limb reduction, quantified here for all crown-urodele families. Limb reduction in ectothermic vertebrates is hypothesized to have evolved convergently in response to living in structured environments, such as, in the case of amphiumids and sirenids, densely vegetated coastal plains. Palaeoclimatic simulations performed herein, together with palaeobotanic proxies, support this hypothesis for the extinct batrachosauroidid as well, since north-western North America and Central Europe fall during the Late Cretaceous and middle Eocene, respectively, in the same palaeo-Köppen climate zones of the present-day Florida and neighbouring areas (Cc and As/Aw). This region of North America is the one currently inhabited by amphiumids and sirenids, suggesting a link between tropical environments and the distribution of extant, limb-reduced, paedomorphic salamanders. This correlation is further supported by the fossil record: the extinction of batrachosauroidids matches the progressive disappearance of tropical climatic ranges in Europe after the Miocene, while the contractions and shifts in the distributions of amphiumids and sirenids reflect the changes in extent and location of tropical zones in North America.

[Talk] [non-student]

Neuroanatomy of sabertoothed cats (Carnivora, Felidae): insights into social and sensory behaviour

Joan Madurell-Malapeira[1,*], Saverio Bartolini-Lucenti[1], Ilaria Meli[1], Darío Fidalgo[2], Narimane Chatar[3], Alberto Boscaini[4], Margot Michaud[5,6], Alexander Lavrov[7], Qigao Jiangzuo[8], Francisco Prevosti[9], Justin Adams[10,11], Camille Thabard[12], Jean Baptiste Fourvel[13], Nikolai Spassov[14], Denis Geraads[15] & Lorenzo Rook[1]

[1] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;

[2] Department of Palaeobiology, Museo Nacional de Ciencias Naturales (CSIC), Madrid, Spain;

[3] Functional Anatomy and Vertebrate Evolution Lab, Department of Integrative Biology, University of California Berkeley, Berkeley, USA;

[4] Instituto de Ecología, Genética y Evolución de Buenos Aires (IEGEBA), Facultad de Ciencias Exactas y Naturales, Universidad de Buenos Aires, Argentina;

[5] Institut Polytechnique UniLaSalle, Université d'Artois, Mont-Saint-Aignan, France;

[6] Evolution and Diversity Dynamics Lab, Universitè de Liège, Liège, Belgium;

[7] Borissiak Palaeontological Institute, Russian Academy of Sciences, Moscow, Russia;

[8] Key Laboratory of Vertebrate Evolution and Human Origins, Institute of Vertebrate Palaeontology and Palaeoanthropology, Chinese Academy of Sciences, Beijing, China;

[9] Museo de Ciencias Antropológicas y Naturales Universidad Nacional de La Rioja (UNLaR), La Rioja, Argentina;

[10] Department of Anatomy and Developmental Biology, Biomedicine Discovery Institute, Monash University, Melbourne, Australia;

[11] Palaeo-Research Institute, Faculty of Humanities, University of Johannesburg, Johannesburg, South Africa;

[12] CNRS, TRACES – Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés, Toulouse, France;

[13] Aix Marseille Université, CNRS, UMR, Aix-en-Provence, France;

[14] Department of Palaeontology and Mineralogy, National Museum of Natural History Sofia, Bulgaria;

[15] CR2P, Muséum National d'Histoire Naturelle, CNRS, Sorbonne Université, Paris, France;
[*] joan.madurellmalapeira@unifi.it – presenting author

Keywords: Neuroanatomy, Carnivora, Felinae, Machairodontinae.

Despite recent advances in computed tomographic techniques and their application in vertebrate palaeontology, large carnivorans remain understudied. Here, we present the first comprehensive study of the endocranial anatomy of sabertoothed cats (subfamily Machairodontinae), based on 28 reconstructed brains from the following species: *Homotherium crenatidens*, *Homotherium serum*, *Megantereon cultridens*, *Megantereon adroveri*/*whitei*, *Dinofelis barlowi*, *Dinofelis piveteaui*, *Smilodon fatalis*, *Smilodon populator*, and *Yoshi garevskii*.

We analysed the morphology of gyri and sulci in these specimens, as well as the absolute and relative volumes of different cerebral cortex regions and compared them with a reference sample of 123 extant felid specimens representing the genera *Panthera*, *Acinonyx*, *Puma*, *Herpailurus*, *Leopardus*, *Neofelis*, *Caracal*, *Lynx*, *Catopuma*, *Leptailurus*, *Felis*, *Otocolobus*, and *Prionailurus*.

Our results reveal a wide range of brain morphologies among both extinct and extant members of the family Felidae, yet a generally conservative pattern in sulcal and gyral morphology. For all representatives of Machairodontinae, the morphology of the large hemispheres of the brain is characterized by hypergyrification - all gyri exhibit an increased degree of convexity. Such an organization of the brain surface increases significantly increase neocortical area while maintaining the same hemisphere volume. By contrast,"the relative volumes of the major brain regions (frontal, temporal, parietal, occipital, and cerebellum + brainstem) indicate a proportionally low volume of the frontal cortex in felids as compared with other carnivorans, with notable exceptions observed in some specimens of *Panthera leo* and *Homotherium*, suggesting possible enhanced capacities for social interaction for the later. Similarly, the occipital and cerebellum and the brainstem regions are particularly well-developed in machairodontines, paralleling patterns seen in extant genera such as *Acinonyx* and *Neofelis*, and likely associated with advanced spatial navigation, cognitive abilities, and visual processing.

[Poster] [non-student]

A new plesiosaur from the Toarcian of Holzmaden sheds light on plesiosauroid diversity in the Early Jurassic European epeiric seas

Sven Sachs[1] & **Daniel Madzia**[2,*]

[1] Abteilung Geowissenschaften, Naturkunde-Museum Bielefeld, Bielefeld, Germany;
[2] Department of Evolutionary Paleobiology, Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[*] daniel.madzia@gmail.com – presenting author

Keywords: Plesiosauroidea, Toarcian, phylogeny reconstruction, Holzmaden, Germany.

The lower Toarcian (upper Lower Jurassic) Posidonia Shale (Posidonienschiefer Formation) of Southwest Germany, particularly the fossil-rich deposits near Holzmaden, is among the most significant Lagerstätten for Early Jurassic marine amniotes. These deposits have yielded remarkably complete and well-preserved skeletons of numerous taxa, including members of all three major plesiosaur lineages: plesiosauroids (*Microcleidus brachypterygius*, *Plesiopterys wildi*, *Seeleyosaurus guilelmiimperatoris*), a pliosaurid (*Hauffiosaurus zanoni*), and a rhomaleosaurid (*Meyerasaurus victor*). While these taxa are well documented, recent studies indicate that the full extent of plesiosaur diversity recorded in the Posidonia Shale is still not fully known. We provide the first detailed osteological description of SMNS 51945, a nearly complete and largely articulated skeleton of an osteologically immature plesiosauroid. The specimen was discovered in 1978 in a quarry at Holzmaden and has been housed in the collections of the Staatliches Museum für Naturkunde Stuttgart ever since. Although previously studied, the specimen had not yet been described in detail or assessed from the taxonomic viewpoint. Our examination of SMNS 51945 reveals an unusual combination of morphological characters (including one potential local autapomorphy) that are not affected by ontogeny or preservation. Stratigraphically, the specimen derives from the Lias εII_1, corresponding to the lowermost Posidonienschiefer Formation. This makes it the oldest known plesiosaur specimen from the Holzmaden area. The recognition of SMNS 51945 as a new plesiosauroid taxon not only expands the known taxonomic diversity of lower Toarcian plesiosaurs but also highlights the importance of continued investigation of historically collected material from long-studied localities.

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[Poster] [non-student]

New squamate specimens from the Kimmeridgian Guimarota fossil site (Portugal)

Elisabete Malafaia[1,2,*], Alberto Cabezuelo-Hernández[2] & Adán Pérez-García[2]

[1] Instituto Dom Luiz, Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal;
[2] Grupo de Biología Evolutiva, Departamento de Física Matemática y de Fluidos, Facultad de Ciencias, Universidad Nacional de Educación a Distancia, Madrid, Spain;
[*] efmalafaia@ciencias.ulisboa.pt – presenting author

Keywords: Reptilia, Lepidosauria, Lusitanian Basin, Late Jurassic.

The former Guimarota coal mine, located near Leiria, in the west-central region of Portugal, is recognized as one of the most significant Upper Jurassic microvertebrate fossil localities worldwide. The vertebrate-bearing lignite coal layers have been interpreted as belonging to the Alcobaça Formation and dated to the early Kimmeridgian based on ostracods. This site is particularly renowned for its abundant and diverse fossil record of early mammalians, but a wide array of other vertebrates, including actinopterygians, amphibians, lepidosaurs, turtles, crocodyliforms, dinosaurs, and pterosaurs, have also been recovered. A set of previously undescribed, relatively well-preserved, isolated vertebrae from Guimarota, housed in the Museu Geológico (MG) in Lisbon and mislabelled as belonging to theropod dinosaurs, is described here, and its taxonomic identification is reassessed. These specimens include a cervical (MG 28959) and four dorsal (MG 28954, MG 28955, MG 28958, MG 28960) vertebrae, which are reinterpreted as belonging to small squamates. This interpretation is based on the procoelous morphology of the centra, the presence of anteroposteriorly narrow and dorsoventrally elongate paradiapophyses, and a poorly developed zygosphene-zygantrum complex (recognized in some dorsal vertebrae). The mostly straight axis of the cotyle-condyle system and the internal structure, composed of several small cavities visible in both the centrum and neural arch, indicating non-pachyostotic vertebrae, are features shared with most Pythonomorpha. However, the poorly developed zygosphene-zygantrum complex allow us to exclude the possibility that

the specimens from Guimarota belong to this clade. These specimens share several features with other vertebrae from Guimarota previously attributed to indeterminate anguimorphs, including anteriorly broadened centra with ventrally smooth surfaces, as well as a shortened, broad condyle and a broad, elliptical cotyle. Based on these features, the isolated vertebrae described here are reinterpreted as belonging to Anguimorpha. The study of these specimens contributes to our understanding of the squamate diversity at Guimarota and provides new data to better characterize the poorly documented axial skeleton of the anguimorphs from this locality.

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[Talk] [non-student]

The evolutionary relationships and biogeographic history of diplodocoid sauropod dinosaurs

Philip D. Mannion[1,*] & Andrew J. Moore[2]

[1] Department of Earth Sciences, University College London, London, United Kingdom;
[2] Department of Anatomical Sciences, Renaissance School of Medicine, Stony Brook University, Stony Brook, New York, USA;
[*] philipdmannion@gmail.com – presenting author

Keywords: Dinosauria, Sauropoda, Diplodocoidea, Morrison Formation, biogeography.

Diplodocoidea is a diverse clade of sauropod dinosaurs that comprises three major lineages: Diplodocidae, Dicraeosauridae, and Rebbachisauridae, with the former two united as Flagellicaudata. There has been a recent spate of newly described diplodocoid taxa, as well as additional information on existing species. Of particular significance is *Tharosaurus indicus*, from the Middle Jurassic of India, which was argued to represent a dicraeosaurid and to potentially evidence a Gondwanan origin for Flagellicaudata. Here, we critically reappraise the anatomy of *Tharosaurus* and leverage new morphological data to re-evaluate the phylogenetic relationships and biogeographic history of Diplodocoidea. We incorporate *Tharosaurus* and 12 diplodocoid operational taxonomic units (OTUs) into the largest existing character matrix for eusauropods, add new characters, and revise characters and scores for previously included OTUs. The final matrix (563 characters scored for 139 OTUs) includes 38 uncontroversial diplodocoids. Topological results from phylogenetic analyses under Maximum Parsimony are sensitive to application of equal versus extended implied weighting, but agree that *Tharosaurus* is an indeterminate eusauropod that lacks diplodocoid synapomorphies. Favouring results produced under extended implied weighting with a concavity constant of 12, we present a revised view of diplodocoid relationships. The Upper Jurassic Morrison Formation sauropod *Haplocanthosaurus* is recovered as a non-diplodocimorph diplodocoid. By contrast with previous analyses, the Middle Jurassic Chinese diplodocoid *Lingwulong* is placed as a stem

flagellicaudatan, outside of the diplodocid–dicraeosaurid split. We recover a diverse Dicraeosauridae that includes three Morrison Formation OTUs as its earliest-branching members. Phylogenetically more-nested dicraeosaurids are all Late Jurassic–Early Cretaceous Gondwanan taxa. Diplodocidae includes the Morrison Formation taxon *Kaatedocus* as an early-diverging member, whilst *Tornieria* + *Leinkupal* form a phylogenetically-nested diplodocine clade. The Morrison Formation sauropod *Amphicoelias* is recovered as an early-branching diplodocoid of uncertain affinities, with equally parsimonious placement as a flagellicaudatan, rebbachisaurid, or non-diplodocimorph diplodocoid. Early-diverging rebbachisaurids include Gondwana taxa, as well as the earliest Cretaceous UK taxon *Xenoposeidon*. Within Khebbashia, Limaysaurinae is restricted to South America, whereas Rebbachisaurinae is present in Europe, North Africa, and South America. The stratigraphically youngest known flagellicaudatans are from the Barremian, whereas rebbachisaurids survived until the Turonian or Coniacian. The extinction of diplodocoids appears to have been spatiotemporally staggered. Our results reinforce the view that Flagellicaudata (and probably also Rebbachisauridae) likely originated in Laurasia, but the presence of diplodocoids in Eurasia in the Middle Jurassic suggests a potentially widespread distribution early in their evolutionary history that is likely obscured by sampling failure.

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[Talk] [non-student]

A dinosaur-dominated ichnoassociation from the lower Upper Triassic of Northern Italy: testing the impact of the Carnian Pluvial Episode on the terrestrial faunas

Lorenzo Marchetti[1,*], Matteo Belvedere[2], Valerio Granata[3] & Alberto Collareta[3]

[1] Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[2] Dipartimento di Scienze della Terra, Università degli studi di Firenze, Firenze, Italy;
[3] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;
[*] lorenzo.marchetti@mfn.berlin – presenting author

Keywords: Vertebrate ichnology, Upper Triassic, Carnian Pluvial Episode, dinosaur tracks, NW Italy.

The Late Triassic represents a key time frame for the evolution of dinosaurs which began to rise in the terrestrial ecosystems previously dominated by non-dinosaur archosauromophs and temnospondyl anamniotes. The most significant phase of this faunal transition seems to coincide with the Carnian Pluvial Episode (Julian–Tuvalian transition), after which the theropod and sauropodomorph dinosaurs became the dominant groups. An important source of data on this faunal change is provided by the tetrapod footprint record, including the Carnian locality of Lerici (La Spezia Province, northwestern Italy), which preserves one of the geologically oldest sauropodomorph footprint occurrences (i.e., the type series of *Evazoum sirigui*). Here, we provide a comprehensive description of the as-yet largely uninvestigated tetrapod footprint association from Lerici with the aid of photogrammetry and structured-light scanning techniques. Prior to the systematic study, a rigorous selection of the diagnostic material was performed through an evaluation of the morphological preservation of each specimen. Our results indicate the occurrence of two sauropodomorph ichnogenera (*Evazoum* and specimens that are tentatively assigned to *Eosauropus*), one theropod ichnogenus (*Grallator*), one pseudosuchian ichnogenus (*Brachychirotherium*), and one ichnogenus

commonly referred to lepidosauromorphs (*Rhynchosauroides*). Featuring the earliest co-occurrence of two different sauropodomorph ichnogenera, this ichnoassociation is dominated by dinosaur tracks. Its Late Triassic affinity is obvious, and it substantially differs from the non-dinosauromorph diapsid-dominated ichnoassociation from the nearby Ladinian outcrops of the Monti Pisani. Considering that the track-bearing strata are regarded as mid-Carnian in age, the ichnoassociation in question may be coeval with the Carnian Pluvial Episode, therefore potentially confirming the most recent theories on its influence on the early evolution of dinosaurs.

[Talk] [non-student]

Exceptional tetrapod body impressions and scaly skin traces from the early Permian Bromacker locality (Thuringia, Germany)

Lorenzo Marchetti[1,*], Antoine Logghe[2], Michael Buchwitz[3], Arnaud Rebillard[1,2,4] & Jörg Fröbisch[1,4]

[1] Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[2] Centre de Recherche en Paléontologie - Paris, UMR 7207 - CNRS, MNHN, SU, Muséum National d'Histoire Naturelle, Paris, France;
[3] Museum für Naturkunde Magdeburg, Magdeburg, Germany;
[4] Humboldt-Universität zu Berlin, Institut für Biologie, Berlin, Germany;
[*] lorenzo.marchetti@mfn.berlin – presenting author

Keywords: Resting trace, skin impression, epidermal scales, soft tissues, Paleozoic.

Soft tissues preservation is rare in the body fossil record of terrestrial vertebrates. Nevertheless, such structures can provide invaluable information on the evolution of body shape, integumentary structures (e.g., scales, feathers, hair) as well as reproductive, sensitive and/or digestive organs. An additional source of information comes from the trace fossil record, which more commonly preserves impressions of the soft parts, sometimes including scalation patterns. The famous early Permian Bromacker locality from central Germany (Tambach Formation) yields an exceptional vertebrate trace and body fossil record. However, little attention has been given to vertebrate resting traces up till now. Full body impressions anatomically associated with *Dimetropus* footprints and thereby assigned to sphenacodontid synapsids, include rectangular, rhomboidal or hexagonal rows of epidermal scales recovered on the body, fore- and hindlimbs as well as the tail. Therefore, these are the first unequivocal body impressions of early synapsids and the earliest evidence of epidermal scales within this group. A potential caseid tail impression shows a peculiar arrangement of ventral scales and a vertical slit, interpreted as a cloacal vent, which would again represent the oldest record for synapsids.

Furthermore, a hindlimb and a trunk impression associated with *Ichniotherium* (diadectomorph footprints) show scaly skin as well, consistent with the acquisition of epidermal scales in stem amniotes. Finally, rectangular scales have been observed on digit imprints of *Ichniotherium*, *Dimetropus*, and *Tambachichnium* (varanopid footprints), as well as hexagonal scales on the sole impression of the latter, further confirming the presence of epidermal scales in varanopids. Moreover, common skin folds have been observed on *Ichniotherium* footprints. The astonishing richness and diversity of the resting trace and scaly skin record from Bromacker strongly suggest to reconsider trace fossils as key information source for the evolution of soft tissue and associated structures in terrestrial vertebrates.

[Talk] [student]

An update on the Early Pliocene fossil reptiles from Langebaanweg (South Africa)

Domenico Marchitelli[1,*], Andrea Villa[2], Loredana Macaluso[3], Marco Pavia[1,4], Romala Govender[4,5] & Massimo Delfino[1,2,4]

[1]Dipartimento di Scienze della Terra, Università di Torino, Turin, Italy;
[2]Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Edifici ICTA-ICP, Cerdanyola del Vallès, Barcelona, Spain;
[3]Museo Regionale di Scienze Naturali, Turin, Italy;
[4]Iziko South African Museum, Cape Town, South Africa;
[5]UCTBiological Sciences, University of Cape Town, Cape Town, South Africa;
[*] domenico.marchite@edu.unito.it – presenting author

Keywords: Squamata, Testudines, *Varanus*, tortoises, snakes.

Langebaanweg (LBW) is an Early Pliocene fossiliferous locality situated in the Western Cape Province, South Africa, at a beeline distance of 109 km from Cape Town. The site is internationally renowned for its rich fossil mammalofauna and ornithofauna testifying for both marine and terrestrial assemblages. Along with the remains already studied of these taxa, a diverse and rich palaeoherpetofauna has long been recognized too but it is still largely unstudied. In 1973, Hendey reported on the tortoises being the most abundant remains from LBW, and later, in 1981, he identified fossil remains belonging to the following taxa: Anura, Testudines, Serpentes, Chamaeleonidae, Gekkota, and Varanidae. Even though the reptile fossil record from LBW is extremely abundant, it is greatly underinvestigated, with only a few studies published in the last fifty years, including the recent description of the extinct testudinid tortoise *Chersina langebaanwegi*. Other than *Chersina langebaanwegi*, the turtle palaeodiversity from LBW includes at least four other taxa, one of which is likely a new testudinid taxon that is currently being described (the others are "*Geochelone*" *stromeri*, *Kinixys* sp., and *Pelomedusa* sp.). Adding pieces to the LBW reptile palaeodiversity mosaic, a small yet diverse sample of lizard remains, 242 specimens consisting primarily of cranial elements, was identified at the

family / infraorder rank as belonging to the following taxa: Gekkota, Scincidae, Cordylidae, Chamaeleonidae, and Varanidae (with scincids and cordylids being reported for the first time from the site). Among these, a preliminary analysis of the varanid remains (24 cranial bones, 26 vertebrae, and 2 ilia) indicates a potential referral to a new, extinct, *Varanus* species closely related to *Varanus albigularis*. Completing the LBW reptilian palaeodiversity, we here also report on a sample of 137 snake trunk vertebrae, belonging to the following, previously unreported, taxa: Viperidae, large-sized Elapidae, and at least two morphotypes of "Colubridae *s.l.*" (i.e., colubriforms without hypapophyses across the whole trunk vertebral column), possibly including the oldest evidence for the elapoid pseudaspidid species *Pseudaspis cana*. In conclusion, with at least 12 taxa, LBW stands out as an important tile for the knowledge of the past and present South African reptile fauna, even if marine turtles and crocodylians (that are currently present in South Africa) are absent from the assemblage. Our study further highlights the need for a better understanding of the comparative osteology of extant South African squamates, the scarce knowledge of which is currently hindering a precise identification of the fossil remains of some taxa.

[Talk] [non-student]

Carnivores from Podlesice (eastern Silesia, Poland), the type site for MN 14

Adrian Marciszak[1,*], Grzegorz Lipecki[2] & Mieczysław Wolsan[3]

[1] Department of Palaeozoology, University of Wrocław, Wrocław, Poland;

[2] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[3] Museum and Institute of Zoology, Polish Academy of Sciences, Warszawa, Poland;

[*] adrian.marciszak@uwr.edu.pl – presenting author

Keywords: Pliocene, carnivores, Silesia, Mustelidae, occurrence.

The knowledge of the Early Pliocene fauna of carnivores from Poland (MN 14) is strongly limited. Apart from some words of Kowalski during the 1950s and 1960s, nothing has been changed in this respect. However, the re-discovery of abundant material from Podlesice, the key site for MN 14 in Europe, has led to a complete change of this situation. The locality is especially important because it documents the time immediately after the Messinian Salinity Crisis (5.96–5.33 Ma), a sudden and extensive event, resulting in significant drying and cooling of the climate and a massive diversity losses. Just after the dispersal of carnivores to remote landmasses occurred, resulted to final establishing in Silesia a Microtinae habitat, a specific ecological niche, which was created already during the Mid–Miocene Climate Transition (16.1–11.6 Ma). The period was characterised by massive expansion of the Antarctic ice sheet and global cooling, which resulted in an increase of grasslands. Associated with it, the diversification of rodents and lagomorphs during that period led to increases in many clades among the mustelids, particularly in Ictonychini and Mustelinae. The limb shortening and reduction of the body size allowed them to hunt rodents in tight burrows, tunnels and small crevices.

This process is still quite poorly recognised, but available data indicate that during the Late Miocene–Early Pliocene (MN 12–14) it was that Ictonychini that gained the initial advantage and dominated this environment. This is reflected in the proportions of the remains from

localities from this period, where Ictonychini still have a predominance. Podlesice site is also unique because it is the first and oldest site documenting the co-occurrence of the genera *Baranogale*, *Mustela* and *Vormela* in one area. However, as the finds from slightly younger sites such as Węże 1 (MN 15b, 3.8–3.4 Ma) show, the extremely adaptable and evolutionarily more flexible Mustelinae quickly gained the advantage and dominated the Microtinae habitat. Apart those extra small mustelids, carnivore assemblage from Podlesice including also a relict occurrence of *Pristifelis attica*, first recorded from Poland, and some enigmatic and poorly known forms like *Lutra affinis*. The analysis of the entire fauna from Podlesice and its comparison in a broad, Eurasian context allows us to determine the age of the find at MN 14a (5.3–4.9 Ma).

[Talk] [non-student]

The origin and early evolution of amniotes in phylogenetic context: step 2

David Marjanović[1],[*]

[1] Evolutionsmorphologie, Dynamik der Natur, Museum für Naturkunde – Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[*] david.marjanovic@gmx.at – presenting author

Keywords: Amniota, phylogeny, claws, lung ventilation, amniotic egg.

Ever since the first phylogenetic analyses of early limbed vertebrates in the mid-1990s, there have been only two types of such analyses: (1) from the origin of limbs to that of Amniota, barely reaching into Amniota; (2) covering amniote phylogeny and barely reaching beyond Amniota. This situation made it impossible to research whether the diadectomorphs (including the herbivorous diadectids), captorhinids (containing the herbivorous moradisaurines), araeoscelidian 'diapsids', or certain 'microsaurs' are amniotes. It also made it difficult at best to investigate whether 'microsaurs' or seymouriamorphs are closer to Amniota, whether temnospondyls or anthracosaurs are closer to Amniota, and how close to Amniota the chroniosuchians, the 'gephyrostegids', and *Casineria* are. Likewise, analyses focussing on amniote phylogeny, e.g., on the positions or even contents of Varanopidae and the 'parareptiles' (containing herbivorous clades), may be misdirected if too distant outgroups are used (potentially leading to misrooted, distorted trees). Which taxa are best suited as outgroups for such analyses depends on the mentioned phylogenetic questions.

Since I presented on this topic at the 2022 EAVP meeting, several 'type 2' publications have tried to tackle these issues with many new characters and new µCT data from long-known specimens. They have supported 'microsaurs' close to but outside Amniota, Diadectomorpha yet closer but still outside, araeoscelidians and captorhinids closer still but nonetheless outside Amniota, paraphyletic 'parareptiles' close to uncontroversial diapsids, and Varanopidae proper in the mammalian total group but some presumed varanopids very close to Diapsida instead.

To test these and other results, I greatly enlarged my dataset (with characters and data from the mentioned publications and others) which now spans the range from before the origin of limbs

to the origin of unquestioned diapsids. I find that many characters so far used only in analyses of amniote phylogeny are also informative far outside Amniota, and vice versa. Current results indicate a long amniote stem with seymouriamorphs, diadectomorphs, captorhinids, araeoscelidians, and various small Carboniferous tetrapods. Most ‘parareptiles’ are close to Diapsida, but some lie outside Amniota; most ‘varanopids’ are even closer to Diapsida, but *Varanops* itself is grouped with the caseasaurs and one ‘parareptile’ as the sister-group to all other sauropsids. All ‘microsaurs’ are robustly outside Amniota or Captorhinidae, though their position less close than the seymouriamorphs is weakly supported.

I point out taxa that should be redescribed and discuss characters that support or contradict this tree. I also briefly discuss the evolution of herbivory and costal lung ventilation, the timing of the origin of claws and the origin of Amniota, and the hypothesis of a size squeeze involved in the origin of the amniotic egg.

[Talk] [non-student]

Apparatus stability in *Pseudofurnishius murcianus* (Conodonta) reveals gondolellid evolutionary conservatism

Carlos Martinez-Perez[1,2,*], Philip C. J. Donoghue[2], Bogdan Jurkovšek[3], Katja Oselj[3], Castor Almañanzas-Alpuente[1] & Tea Kolar-Jurkovšek[3]

[1] Institut Cavanilles de Biodiversitat i Biologia Evolutiva, Universitat de Valencia, Valencia, Spain;

[2] Bristol Palaeobiology Group, School of Earth Sciences, Life Sciences Building, University of Bristol, Bristol, United Kingdom;

[3] Geological Survey of Slovenia, Ljubljana, Slovenia;

[*] carlos.martinez-perez@uv.ese – presenting author

Keywords: Conodonta, Gondolellida, apparatus architecture, evolutionary conservatism.

Conodonts, extinct early vertebrates, are mainly known from their tooth-like skeletal elements that form a crucial part of their feeding apparatus. Traditionally, reconstructions of these structures, derived from clusters and natural assemblages, have highlighted an impressive morphological and architectural stability, as evidenced by the few existing studies. In this work, we examine exceptionally well-preserved material of *Pseudofurnishius murcianus* from the Middle Triassic of Slovenia, utilizing both fused clusters and bedding-plane assemblages to reconstruct its apparatus. Our analysis reveals that *Pseudofurnishius murcianus* possessed a 15-element apparatus, consistent with the Gondolelloidea model and, more broadly, with that of Ozarkodinida; this includes symmetrical P1, P2, M, and S1–S4 elements, plus an asymmetrical S0 element. Remarkably, the architecture of *Pseudofurnishius murcianus* closely mirrors that of *Nicoraella*, as confirmed through collapse analysis, underscoring the unique and stable design within gondolellids. Moreover, the natural bedding-plane assemblages of *Neogondolella* conform well with this architecture, supporting the idea of a conserved apparatus model across conodont taxa in this family. Overall, our findings provide compelling evidence for a long-standing pattern of stable, conservative apparatus architecture in Gondolelloidea that extends to the broader Ozarkodinida, shedding light on evolutionary constraints and offering new perspectives on the functional and developmental aspects of these early vertebrates.

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[Talk] [student]

How many hippopotamid species inhabited Sicily during the Pleistocene? the case study of Amoroso Cave (Palermo)

Roberta Martino[1,2,*], Carolina Di Patti[3], Maria Ríos[1,2], Lorenzo Rook[4], Mirko Di Febbraro[5], Pasquale Raia[6] & Luca Pandolfi[7]

[1] GEOBIOTEC, Department of Earth Sciencies, NOVA School of Science and Technology, Universidade NOVA de Lisboa, Caparica, Portugal;
[2] Museu da Lourinhã, Lourinhã, Portugal;
[3] Museo Geologico ‘‘G.G. Gemmellaro’’- Universita` degli Studi di Palermo, Palermo, Italy;
[4] Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;
[5] EnviX-Lab, Dipartimento di Bioscienze e Territorio, Università degli Studi del Molise, Pesche, Italy;
[6] Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse. Università di Napoli Federico II, Napoli, Italy;
[7] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;
[*] r.martino@campus.fct.unl.pt – presenting author

Keywords: Mediterranean area, insularism, *Hippopotamus amphibius, Hippopotamus pentlandi,* Quaternary.

Hippopotamus pentlandi represents one of the best-known insular hippopotamid species within the Mediterranean region. This hippopotamid inhabited Sicily most likely from the late Middle Pleistocene until the Late Pleistocene. *Hippopotamus pentlandi* is recorded in the “*Palaeoloxodon* sp. Faunal Complex”, alongside a well-balanced mammal assemblage that also includes *Palaeoloxodon* sp., *Cervus elaphus siciliae*, *Canis lupus*, *Dama carburangelensis*, *Ursus* cf. *arctos*, *Crocuta crocuta spelaea*, *Bos primigenius siciliae*, *Sus scrofa*, and *Vulpes vulpes*. Abundant hippopotamid material was collected in Sicily throughout many years, however, only a small part was properly studied. Among these unstudied remains, a well-preserved mandible from Amoroso Cave (Palermo) offers useful insights into the variability of

the hippopotamids that once inhabited the island during the Pleistocene. The morphological and morphometric analyses reveal a significant similarity between the Amoroso mandible and specimens retrieved from San Ciro Cave, as well as with continental (extant and fossil) *Hippopotamus amphibius*. In contrast, the mandibles ascribed to *Hippopotamus pentlandi* coming from Cannita Cave are less sturdy, more elongated and smaller than the previously mentioned taxa. 3D Geometric Morphometric analysis performed on the symphyseal sagittal cross-section also reveals a closer affinity of the mandible from Amoroso to both *Hippopotamus amphibius* and to the specimens collected from San Ciro Cave. Following these results, the Amoroso mandible can be tentatively ascribed to *Hippopotamus amphibius*. This outcome confirms the presence of at least two different taxa in Sicily during the late Middle Pleistocene-Late Pleistocene period: *Hippopotamus pentlandi* primarily known from Cannita Cave, and *Hippopotamus amphibius*. Further studies are required on the abundant unpublished material in order to acquire a more thorough understanding of the hippopotamid variability in Sicily as well as further insights into their palaeobiogeography, palaeobiology, and palaeoenvironment.

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[Poster] [non-student]

Re-evaluation of historic putative caimanine (Crocodylia) material from the lower Paleocene Salamanca Formation in Patagonia (Argentina)

Tobias Massonne[1,2,*] & Felix J. Augustin[1]

[1] Department of Geosciences, University of Tübingen, Tübingen, Germany;

[2] Bavarian State Collection for Palaeontology and Geology, Munich, Germany;

[*] tobias.massonne@uni-tuebingen.de – presenting author

Keywords: Crocodylia, Eusuchia, Caimaninae, *Caiman*, Punta Peligro.

The fossil record of caimanines is characterised by two important periods: the first in the early Paleocene and the second in the Late Miocene. While numerous well-preserved taxa are known from the latter period, the incompleteness of fossils from the Paleocene poses a significant challenge to the understanding of the evolution of Caimaninae. Here, we re-describe material collected by the German palaeontologist Friedrich von Huene in 1924 from outcrops of the Salamanca Formation at Cap Peligro in Patagonia, Argentina. The material consists of several isolated bone fragments (i.e., a frontal, parietal, dentary and angular, as well as seven vertebrae, three femora, four metatarsals and two osteoderms), currently housed in the Palaeontological Collection of the University of Tübingen in Germany. The size differences between the bones clearly indicates that they belong to different individuals; due to a lack of overlapping elements, it is unclear if they all belong to a single or, instead, to several distinct species. A comparison with recently described caimanines from the Paleocene and Eocene of South America (i.e., *Eocaiman cavernensis*, *Eocaiman itaboraiensis*, *Eocaiman palaeocenicus*, *Necrosuchus ionensis*, and *Protocaiman peligrensis*) shows that the material presented herein differs in lower jaw morphology from all other species (except *Protocaiman peligrensis* for which the lower jaw is unknown), but that the skull bones show a great similarity to those of *Protocaiman peligrensis*. The absence of overlapping skull material from all other species and of lower jaw material of *Protocaiman peligrensis* leads to the cautious assignment of the herein presented material to Caimaninae indet.

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[Talk] [student]

Red fox *Vulpes vulpes* (Linnaeus, 1758) and Arctic fox *Vulpes lagopus* (Linnaeus, 1758) from South Moravian sites of the Late Pleistocene - analysis of bone remains from Pavlov I and Dolní Věstonice I sites

Lena Matyaszczyk[1,*]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[*] matyaszczyk@isez.pan.krakow.pl – presenting author

Keywords: Pleistocene, *Vulpes vulpes*, *Vulpes lagopus*, Czech Republic.

The Late Pleistocene was a period during which the red fox and the Arctic fox coexisted in Central Europe. This situation continued until around 25,000 years ago, when a significant cooling of the climate forced the red fox to gradually retreat to warmer regions. The harsh climate of this period was particularly favorable for the Arctic fox, which was well adapted to endure low temperatures. Beyond the influence of climate on Pleistocene fox populations, their interactions with human communities are especially intriguing. At the South Moravian sites of Pavlov I and Dolní Věstonice I, traces of the Pavlovian culture have been found. At these sites, dated to approximately 32,000 years ago, fox bones showing signs of human processing were also discovered. In addition to providing high-quality fur, foxes may also have been a source of food for hunter-gatherer societies. This is suggested by cut marks on the bones, located in areas typically associated with skinning and butchering.

The aim of the research was to determine whether foxes were used by the people living in the area and, if so, in what ways. The study also examined whether there were any noticeable morphological differences between these ancient foxes and modern populations. The analyses were based on measurements of long bones and the first lower molar (m1). Osteometric analysis, along with weight and height estimation methods, revealed size differences between

fossil and modern specimens. This is particularly evident in the case of the red fox, which appears to have been significantly larger than today's representatives of the species.

Funding: This research is conducted within the ERC CoG project "Exploring Mammoth Bone Accumulations In Central Europe" (MAMBA) number 101045245, led by Dr. hab. J. Wilczyński from the Institute of Systematics and Evolution of Animals, Polish Academy of Sciences in Kraków.

[Talk] [non-student]

Exploring early diversity in pachycormid fishes

Erin E. Maxwell[1,*] & Samuel L. A. Cooper[1]

[1] Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany;

[*] erin.maxwell@smns-bw.de – presenting author

Keywords: Actinopterygii, Teleosteomorpha, Pachycormiformes, morphology, evolution, Jurassic.

Pachycormidae was a successful clade of bony fishes that inhabited the world's oceans from the Early Jurassic to the Late Cretaceous (117 Ma). These fishes are well-known for their body size and trophic disparity, but also for their highly modified anatomy and trends towards reduced skeletal mineralization. The earliest fossil record of this group is well-sampled, with the first appearance of Pachycormidae occurring during the early Toarcian, a time of widespread deposition of konservat-lagerstätte, particularly across Europe and the United Kingdom. We surveyed Toarcian pachycormids from the Posidonienschiefer Formation of southwestern Germany to assess early diversity and character evolution in the clade. Results indicate that diversity was high early in the evolutionary history of these fishes, with at least eleven taxa present (eight named) representing both major subclades as well as coeval early-diverging taxa. The latter group includes at least two species of *Euthynotus* as well as *Haasichthys*, and reveals a complex evolutionary trajectory for many characters used to define Pachycormidae including the pattern of fin-ray branching and segmentation, and scale articulation and reduction. A deeper look at common pachycormid characters also raises questions regarding the homology of some diagnostic features (e.g., enlarged suborbitals, hypural plate), potentially affecting deeper-level phylogenetic placement. It appears as though, with the exception of the toothed rostrodermethmoid and expanded 'suborbitals', many pachycormid synapomorphies appeared in the Toarcian during the initial radiation of the group, coexisting with primitive morphologies,

challenging the definition of Pachycormidae, and creating phylogenetic instability near the base of the clade. Reconstructing phylogeny taking these aspects into account also highlights that Hypsocorminae, the ‘toothed’ pachycormid subclade, is currently defined largely based on plesiomorphic characters. By focusing on the earliest pachycormids, we hope to understand the origins and early radiation of the group based on a stable phylogenetic framework and identify key adaptations leading to their indisputable evolutionary success.

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[Talk] [student]

First neuroanatomical description of *Megantereon cultridens* (Carnivora, Felidae) in comparison with extant felids

Ilaria Meli[1,*], Joan Madurell-Malapeira[1], Saverio Bartolini-Lucenti[1] & Lorenzo Rook[1]

[1]Dipartimento di Scienze della Terra, Paleo[Fab]Lab, Università degli Studi di Firenze, Florence, Italy;
* meliilaria02@gmail.com – presenting author

Keywords: Machairodontinae, neuroanatomy.

Recent advances in computer tomography (CT) techniques have allowed palaeontologists to explore internal structures in fossil species like never before, opening new paths to understand ecological, functional and behavioural specializations. Brain endocasts have been of particular interest in this field of investigation.
Here we present for the first time the endocasts of three specimens of *Megantereon cultridens* (Carnivora, Felidae, Machairodontinae), two of which are complete and allow a detailed description of the neuroanatomy and sulcal pattern. We then compared them with a reference sample of extant felids encompassing species both from the subfamily Felinae and Pantherinae applying traditional and geometric morphometrics and evaluation of regional brain volumes.
Overall, felids show a generally conservative sulcal and gyral morphology, consistent with the fairly homogeneous ecology of the group. *Megantereon cultridens* fits itself well into this framework, although displaying characteristics, which point to a mosaic of Felinae-like and Pantherinae-like features in its cerebrum. Morphometrics confirms this intermediate condition of *Megantereon cultridens*. The cerebellum appears well developed, likely linked to enhanced spatial and motor abilities, as does the frontal lobe, which has been shown to be involved in both social and psychomotor skills. A peculiar pattern in the temporal lobe could indicate different hearing abilities than those seen in extant felids.

[Talk] [non-student]

A reappraisal of the iconic ankylosaur trackway *Ligabueichnium bolivianum* Leonardi from the Late Cretaceous (Maastrichtian) of Bolivia (El Molino Formation, Parque Nacional de Toro Toro, Bolivia) - Facts and fiction

Christian Andreas Meyer[1,2,*], José Hugo Heymann[3], Alfonso Alem Rojo[4], Dorothee Hippler[2,5], Ricardo Cespedes Paz[2], Ismar de Souza Carvalho[2,6] & Lara Sciscio[2,7,8]

[1] Departement of Environmental Sciences, University of Basel, Basel, Switzerland;
[2] Museo de Historia Natural Alcide d'Orbigny, Cochabamba, Bolivia;
[3] Sucre, Bolivia;
[4] Rumi Kipu, Km2 Carrera Toro Toro - Cochabamba, Bolivia;
[5] Graz University of Technology, Institute of Applied Geosciences, Graz, Austria;
[6] Instituto de Geociências, Universidade Federal do Rio de Janeiro, CCMN, Rio de Janeiro, Brazil;
[7] JURASSICA Museum, Porrentruy, Switzerland;
[8] Département des Géosciences, Université de Fribourg, Fribourg, Switzerland;
[*] chris.meyer@unibas.ch – presenting author

Keywords: *Ligabueichnium bolivianum*, dinosaur trackways, Late Cretaceous, Toro Toro National Park, Bolivia.

The first report on dinosaur tracks in the Parque Nacional de Toro Toro (Dep. Potosí, Bolivia) came from the Austrian geologist Unterladstätter, which reported tracks of something like "a gigantic ostrich". In 1961, Branisa accompanied by the German geologist Lohmann visited Toro Toro and discovered the iconic trackway *Ligabueichnium* later described by Leonardi. First Leonardi attributed the trackway either to an ankylosaur or a ceratopsian, later he stated that it belongs to an ankylosaur. The trackway occurs in the Lower Member of the El Molino Formation (?Early Maastrichtian). In 2019 the senior author visited the original to study the preservation and the trackway configuration. In 2024 a fresh, unaltered trackway segment with manus and pes impressions has been documented. The segment occurs in a coeval stratigraphic position, but preserved as underprints. The pentadactyl pes and tetradactyl manus impressions

indicate a thyreophoran (likely ankylosaurian) origin. The footprint size (PL:PW of 40:27cm) from this segment is not much smaller than in the type trackway of *Ligabueichnium* (PL:PW of 40:35 cm) and points to an animal with a ~1.2 m trunk length. Today the type trackway is represented by deep pes prints. As no digit impressions are preserved, it is impossible to see if the pedes are tetradactyl. However, the trackway pattern and the wide gauge are reminiscent of known ankylosaur tracks. Upon reevaluation of the data obtained in 2019 alongside with the recently discovered tracks and trackways, we conclude that the *Ligabuechnium* trackway is made up of pes prints only and problaby represents underprints.

Trackways with a similar gauge and pattern from the El Molino Formation of Ninu Mayu (Dep. Chuquisaca, Bolivia) were attributed to cf. *Tetrapodosaurus* and a nodosaurid ankylosaurs. Due to their peculiar preservation, it has been suggested that the animals were in buoyant state when making the tracks. However, their preservation and appearance closely resemble tracks and trackways from the famous Cal Orck'o locality (Sucre, Dep. Chuquisaca), where they have been assigned to ankylosaurs without being ascribed to a specific ichnotaxon thus far. The study of a recently discovered tracksite from the El Molino Formation near Toro Toro (Dept. Cochabamba, Anzaldo), featuring exceptionally well-preserved trackways resembling *Ligabueichnium* and possibly produced by thyreophoran (ankylosaurs), will help clarify the ichnotaxonomic status of both the type of *Ligabueichnium bolivianum* and other known thyreophoran trackways from the Late Cretaceous of Bolivia.

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[Poster] [student]

A geometric morphometric approach for the identification of isolated pubic bones of marine reptiles from the Muschelkalk of the Germanic Basin: preliminary results

Julia Michalska[1,*] & **Tomasz Skawiński**[1,*]

[1] Museum of Natural History, University of Wrocław, Wrocław, Poland;

[*] 322640@uwr.edu.pl (JM) & tomasz.skawinski@uwr.edu.pl (TS) – presenting authors

Keywords: Central European Basin, morphometrics, pelvic girdle, Sauropterygia, Triassic.

The Middle Triassic Muschelkalk deposits of the Central European Basin have yielded numerous fossils of marine reptiles, mostly sauropterygians. Unfortunately, the vast majority of these finds are isolated elements. The taxonomic assignment of such isolated fossils is, obviously, difficult. Girdle bones may be particularly problematic because of their high variability and the fact that similar morphologies have often been acquired convergently. Here, we attempted to evaluate the taxonomic affinity of an isolated pubis from the Muschelkalk of Nakło Śląskie, southern Poland, by comparing it to a range of marine reptiles in a geometric morphometric analysis. In the Principal Component Analysis, the plate-like, round pubes (the bone from Nakło Śląskie, cf. *Blezingeria*, *Hanosaurus*, *Largocephalosaurus*, *Pararcus* and, to a lesser degree, *Pistosaurus*) form a well-differentiated cluster which occupies a separate morphospace from other reptiles. When only taxa from the Germanic Basin are analysed, the bone from Nakło Śląskie clusters with *Pararcus* and cf. *Blezingeria*. This, together with the character analysis, is consistent with the referral of this bone to *Pararcus*. If correct, this would be the first record of this taxon from outside Winterswijk, the Netherlands. However, due to the high variation observed in the pubic bones of closely related species (e.g., *Nothosaurus* spp.) and convergences between distantly related taxa, caution is warranted even in taxonomic assignments using statistical methods.

[Talk] [non-student]

The cranium of the enigmatic Triassic reptile *Eusaurosphargis* from a new specimen from Winterswijk, the Netherlands, and implications for sauropterygian evolution

Feiko Miedema[1,2,*], Torsten M. Scheyer[1], Dylan Bastiaans[3], Stephan N. F. Spiekman[4], Dave Spiller & Nicole Klein[4,5]

[1] Universität Zürich, Paläontologisches Institut, Zurich, Switzerland;
[2] Universitetet i Oslo/Naturhistorisk Museet Oslo, Oslo, Norway;
[3] Natuurhistorisch Museum Maastricht, Maastricht, the Netherlands.;
[4] Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany;
[5] Institute of Organismic Biology, Department for Palaeontology, University of Bonn, Bonn, Germany;
[*]feiko.miedema@gmail.com – presenting author

Keywords: *Eusaurosphargis*, Sauropterygia, Middle Triassic, Placodontia, morphology

The origins of Sauropterygia and its position within Diapsida are obscure due to lack of early and terrestrial relatives. One enigmatic species that has recently been proposed to be a close relative to the Sauropterygia is *Eusaurosphargis dalsassoi*, a species originally established from the Middle Triassic of Italy. Neither the holotype nor any subsequent referred material preserves enough articulated cranial material to get a good grip on its anatomy. Here, we present a new specimen referable to *Eusaurosphargis* due to the morphology of osteoderms associated with the neural arches of cervical, dorsal, and sacral vertebrae and the transverse processes of the dorsal vertebrae. This specimen preserves an almost complete, and mostly articulated cranium, lacking only the frontals and vomers. Also preserved are the cervical region, a portion of the posterior trunk and sacral region, anterior tail and right hindlimb. The specimen heralds from layer 9 of the Winterswijk Muschelkalk-quarry in the Netherlands and is dated to the early Middle Triassic. As little of the specimen was exposed, it was CT scanned; subsequent segmentation allowed for the 3D-reconstruction of the complete cranium in Blender. The 3D-reconstruction of cranium shows striking similarities with the outline of the early placodont

Palatodonta bleekeri (likewise known from Winterswijk). This prompted us to review the scan data for that species as well. We identified several new elements in the *Palatodonta* holotype, largely those of chondro- and splanchnocranial origin. We found clear morphological differences between *Eusaurosphargis* and *Palatodonta*, demonstrating that the two are indeed different taxa. Among those are the morphology of the quadrate, which is more robust and quadrangular in *Palatodonta* and more mediolaterally compressed and slender in *Eusaurosphargis*. The palatine dentition is likewise different, being more medially placed in *Palatodonta* and distinctly laterally placed in *Eusaurosphargis*. Interestingly, both *Palatodonta* and *Eusaurosphargis* have a medially open endosseous labyrinth, more like ichthyosaurians and early neodiapsids than derived sauropterygians and archosaurs. *Eusaurosphargis* is further unique in having a dorsal process of the stapes, to our knowledge only known in early diverging reptiles. We added the new data on *Eusaurosphargis* and *Palatodonta* as well as the other enigmatic placodont from Winterswijk, *Pararcus diepenbroeki*, to two recently published matrices that focus on the early relationships of sauropterygians. We recovered all taxa as sister to Sauropterygia and Saurosphargidae. This largely resembles previous results and implies that 1) *Palatodonta* and *Pararcus* may be relatives of the Sauropterygia rather than an early placodonts; 2) *Eusaurosphargis* is a potential terrestrial sauropterygian relative.

[Poster] [non-student]

Early Ruscinian small vertebrates from Yeguas (Guadix Basin, Southern Iberian Peninsula)

Raef Minwer-Barakat[1,2,*], Arnau Bolet[1,3], Antonio García-Alix[2], Elvira Martín-Suárez[2] & Matthijs Freudenthal[2]

[1] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain;
[2] Departamento de Estratigrafía y Paleontología, Universidad de Granada, Granada, Spain;
[3] School of Earth Sciences, University of Bristol, Bristol, United Kingdom;
[*] raef.minwer@icp.cat – presenting author

Keywords: Rodents, insectivores, squamates, Pliocene, Spain.

The Guadix Basin in Southern Spain holds a rich vertebrate fossil record, ranging from the latest Miocene to the Late Pleistocene. Some time intervals, such as the early Ruscinian, are still poorly studied in this area. The locality of Yeguas, located in the central sector of the basin, was first mentioned in 1991, but only a preliminary faunal list was published, together with its assignment to the early Ruscinian. Further sampling of this site carried out in the 2000s led to the recovery of additional fossil material, described in an unpublished dissertation. Here we analyze for the first time all the vertebrate remains coming from Yeguas, including specimens recovered during the 1990 decade, which are deposited at the Museo Nacional de Ciencias Naturales in Madrid, and those obtained in the 2000 decade, stored at the Universidad de Granada. This study has revealed a more diverse assemblage than previously reported, which include several taxa never mentioned before from this site. Among rodents, murids are particularly diverse and include specimens assigned to *Stephanomys*, *Paraethomys*, *Occitanomys* and *Castillomys*. In addition, scarce teeth are attributable to the cricetid *Apocricetus* and the glirid *Eliomys*, whereas the trilophomyid *Trilophomys* is only represented by some enamel fragments. Regarding eulipotyphlans, two soricid genera are identified, *Asoriculus* and *Paenelimnoecus*, together with a fragment of a lower molar that could

correspond to either an erinaceid or a talpid. Finally, the few squamate remains identified represent the first records in the locality of a group that has been barely studied in this basin during the early Ruscinian. Several dentaries and a premaxilla can be attributed to lacertids, whereas an osteoderm allows the identification of an anguine. The assemblage from Yeguas includes several typical early Ruscinian taxa, such as *Stephanomys cordii, Castillomys gracilis* and *Apocricetus barrierei,* thus confirming the age established in previous works. A more detailed study of this material will contribute to improve the knowledge about the vertebrate fauna that inhabited southern Spain during the Early Pliocene.

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[Poster] [non-student]

Late Eocene Primates from Sierra Palomera (Spain)

Raef Minwer-Barakat[1,2,*], Judit Marigó[1,3] & Matthijs Freudenthal[2]

[1] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain;
[2] Departamento de Estratigrafía y Paleontología, Universidad de Granada, Granada, Spain;
[3] Departament de Geologia, Universitat Autònoma de Barcelona, Cerdanyola del Vallès, Spain;
[*] raef.minwer@icp.cat – presenting author

Keywords: Euprimates, Microchoerinae, Cercamoniinae, latest Eocene, Spain.

The Sierra Palomera (Teruel province, Spain) is a North-South mountain range consisting of Jurassic limestones unconformably overlain by Paleogene and Neogene continental deposits. This area is known by its well-exposed sections recording the Eocene–Oligocene transition. Despite the paucity of fossils in most levels, extensive field campaigns carried out during the 1980s, 1990s, and 2000s (involving the recovery of up to 20 tons of sediment from some beds) allowed obtaining abundant small mammal remains, including mainly rodents (particularly pseudosciurids, theridomyids, and glirids), 'insectivores' (eulipotyphlans), and marsupials. In contrast, only one primate specimen has been reported to date: a single lower molar attributed to *Microchoerus* sp. from the locality of Aguatón, dated to the earliest Oligocene, which was published in 2001 and represents one of the few Paleogene primate records in Europe after the Eocene–Oligocene faunal turnover known as the Grande Coupure. Now, we have carefully revised the vertebrate collections coming from other late Eocene and early Oligocene levels in Sierra Palomera (currently housed at Universidad de Granada, although they will be permanently curated at Universidad de Zaragoza after their study), identifying some additional primate remains, all of them from localities dated to the late Eocene. Most of these remains are also attributable to the omomyid genus *Microchoerus*, including six teeth from the level named Aguatón 5A, one from Aguatón 2D and one more from Villarrosano 15A. These teeth are larger and morphologically more complex than those of *Microchoerus hookeri* from the late Eocene locality of Sossís in the Pyrenees. Moreover, a single upper molar from Aguatón 2D can be

assigned to the genus *Pseudoloris*. This genus is common in middle and late Eocene Iberian sites and has also been identified in the early Oligocene localities of Fonollosa and Santpedor (Ebro Basin), but this finding represents its first mention in Sierra Palomera. Finally, a single fragmented lower molar from Aguatón 2D can be assigned to an undetermined Cercamoniinae, which represents the latest occurrence of an adapiform primate in the Iberian Peninsula. Although scarce, the described material is of great interest, particularly by its age close to the Grande Coupure. A more detailed study of these remains will contribute to a better knowledge of the primate faunas that inhabited the Iberian Peninsula just before the climatic deterioration that took place at the Eocene–Oligocene transition.

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[Poster] [student]

Postcranial skeleton of the capitosaur *Calmasuchus acri* (Temnospondyli) from the Anisian (Middle Triassic) of the Catalonian Basin (NE Iberian Peninsula)

Javier Mora[1,*] & Josep Fortuny[2]

[1] Área de Paleontología, Facultad de Ciencias Geológicas, Universidad Complutense de Madrid, Madrid, Spain;
[2] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Barcelona, Spain;
[*] jmora08@ucm.es – presenting author

Keywords: *Calmasuchus*, Triassic, postcranial anatomy, Temnospondyli.

The La Mora site (Barcelona, Spain) represents one of the few Triassic bone-bearing localities in continental environments of the Iberian Peninsula, being the type locality of the capitosaur *Calmasuchus acri,* one of the few known temnospondyls from the Iberian record. Geologically, the site has been interpreted as a large muddy floodplain containing meandering fluvial channels belonging to the Buntsandstein facies, dated as early to middle Anisian (Middle Triassic). Herein, we present the description of the first tetrapod specimen recovered, discovered in 1989 a few hundred meters far from La Mora site. The specimen is represented by a semi-articulated skeleton of a capitosaur temnospondyl, assigned to *Calmasuchus acri*. The specimen fits in size with specimens recovered at La Mora locality and only preserves postcranial elements, including articulated axial elements, both intercentra and ribs, as well as elements from the pectoral girdle and forearm. Additionally, we also present the description of multiple postcranial elements (coming from both the axial skeleton and the pectoral girdle) from additional capitosaurs recovered from La Mora site.

Funding: Funding provided by CERCA Programme and Departament de Cultura (Generalitat de Catalunya).

[Poster] [student]

Inside the proboscidean mouth: preliminary report on dental microwear analysis of Pliocene and lowermost Pleistocene species from Tuscany (central Italy)

Federica Mulè[1,2,*], Florent Rivals[3,4,5], Giovanni Bianucci[1] & Luca Pandolfi[1]

[1] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;
[2] Corso di Dottorato in Geoscienze e Ambiente, Università di Pisa, Pisa, Italy;
[3] ICREA, Barcelona, Spain;
[4] Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA), Universitat Rovira i Virgili, Tarragona, Spain;
[5] Departament d'Història i Història de l'Art, Universitat Rovira i Virgili (URV), Tarragona, Spain;
[*] f.mule@phd.unipi.it – presenting author

Keywords: *Anancus*, *Mammuthus*, browser, Pliocene–Pleistocene, Valdarno.

Proboscideans play an important role to modify, maintain and create habitats and represent a key mammal group for palaeoenvironmental and palaeoclimatic reconstructions. In this work we use proboscidean teeth as palaeoenvironmental proxy to reconstruct habitat and dietary changes during the Pliocene and the lowermost Pleistocene of Tuscany (central Italy). We apply Dental Microwear Analyses (DMA) to assess microwear features by examining their abundance, distribution, size and shape using high-resolution replicas observed under a stereomicroscope at a 35x magnification. Microwear features are created during chewing by particles (e.g., plant phytoliths, exogenous dust) that are harder than tooth enamel. The main features are scratches (length > width) and pits (width ≈ length), which help differentiate grazing (more scratches, for eating grasses which are plants rich in phytoliths) from browsing (more pits, for feeding on dicotyledonous plants with a lower content in phytoliths). The results suggest that the gomphotheriid *Anancus* is characterised by few scratches (mostly coarse and hypercoarse) and many large pits, puncture pits and gouges. These microwear features are consistent with a diet composed by leaves, fruits, seeds, and bark (browse-dominated feeding).

However, the frequency of scratches and pits varies among different individuals. This variability has been observed in modern elephants and *Anancus* specimens from other European localities, probably related with small dietary shifts within the same population, likely in response to changes in resource availability or ontogenetic stages of the individuals. In contrast, the elephantid *Mammuthus meridionalis* falls within the dirty browser ecospace, being characterised by very few scratches (fewer than those seen in *Anancus*) and extremely high number of pits. When the total number of pits significantly exceeds 40, it may be attributed to the ingestion of dust or other particles from the surface of consumed vegetation. Such a pattern is typically associated with arid climatic phases, which likely characterized the period during which *Mammuthus meridionalis* lived in the lowermost Pleistocene. The present study represents the first analysis of a large set of data that will provide a better framework on past ecosystems and dietary shifts in extinct proboscideans from the Tuscan Pliocene to the beginning of the Quaternary.

[Poster] [student]

µCT scans reveal new information about dental replacement in the superfamily Djadochtatherioidea (Mammalia, Multituberculata)

Paweł Muniak[1,*] & Łucja Fostowicz-Frelik[2]

[1] Institute of Biology, University of Opole, Opole, Poland;

[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[*] pawel.muniak@yahoo.com – presenting author

Keywords: Microcomputed tomography scanning, Mongolia, Djadochtatheriidae.

Evidence of dental replacement in extinct mammals is relatively rare in the fossil record. Despite that fact, in the last five decades, we observe increasing interest in this topic studied in different mammalian groups. Dental replacement in Multituberculata is poorly known, and the sequence of tooth replacement is unclear, particularly whether the sequence of dental eruption in Multituberculata is antero-posterior or postero-anterior. We studied the µCT-scans of the skulls of *Kamptobaatar* and *Chulsanbaatar* specimens from the collection of the Institute of Paleobiology, Polish Academy of Sciences in Warsaw. The µCT scans reveal that *Kamptobaatar* has the antero-posterior sequence of dental replacement, while *Chulsanbaatar* has the postero-anterior sequence. Based on the phylogenetic position of *Chulsanbaatar* it is possible that the postero-anterior direction of dental exchange is derived. Moreover, all reported specimens of *Kamptobaatar* have apparently deciduous premolars. Our study indicates that the permanent premolars in this genus are smaller than half the size of the deciduous ones, which may suggest a unique dietary preference different for juvenile and adult specimens, sexual dimorphism or pathologies. For the first time, we observe in *Chulsanbaatar* a rotational eruption of I3, which could have been related to a possible delay in the I3 eruption. Our data allowed us to uncover some specific features about dental replacement in the superfamily Djadochtatheriidae.

[Talk] [non-student]

A new notosuchian (Crocodylomorpha) phylogeny reveals the complex evolutionary history of sebecids

Cecily S. C. Nicholl[1,*], Diego Pol[2] & Philip D. Mannion[1]

[1] Department of Earth Sciences, University College London, London, United Kingdom;

[2] Sección Paleontología, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" (MACNBR-CONICET), Buenos Aires, Argentina;

[*] Cecily.nicholl@ucl.ac.uk – presenting author

Keywords: Crocodylomorpha, Notosuchia, Sebecosuchia, systematics, biogeography.

Notosuchians are an extinct, taxonomically and morphologically diverse clade of largely terrestrial crocodyliforms known predominantly from the Cretaceous of Gondwana. The internal systematics of this group are in continuous debate, most notably concerning the phylogenetic placement of the group Sebecidae, which is found to have affinities with both baurusuchians and peirosaurians. Much of the uncertainty surrounding the interrelationships of these crocodyliforms stems from the fact that many specimens assigned to these groups are highly fragmentary, most notably those from the Paleogene of Europe and Africa. To resolve these issues, we critically examine the underlying characters utilised in Notosuchian systematics, particularly in terms of their construction. The largest and most comprehensive notosuchian dataset to date is compiled, comprising 540 morphological characters scored for 120 species. All existing characters are reviewed, and many are modified extensively. 113 novel characters are constructed, many of which focus on previously undersampled regions of the skeleton (postcrania and the endocranium). Continuous characters are utilised for the first time in the context of Notosuchia, and taxon sampling is increased, in part, via inclusion of seven notosuchians that have not previously been assessed in a phylogenetic context. Analyses conducted under maximum parsimony using both equal and extended implied (k = 8 and 12) weighting schemes reveal strong support for a monophyletic Sebecosuchia (Baurusuchia + Sebecoidea). Within this group, the taxonomic content of Sebecidae, supported by features such as a newly recognised elongate ridge along the ventrolateral surface of the dentary, is expanded

via inclusion of the redescribed *Eremosuchus elkoholicus* from the Eocene of Algeria, as well as *Doratodon* and *Ogresuchus furatus* from the Late Cretaceous of Europe. The addition of European remains within Sebecidae increases the temporal range of a clade previously considered to be restricted to the Cenozoic. Furthermore, despite long held views that the group originated in South America, the presence of a diverse, deeply nested sebecid clade containing taxa from outside of this region could suggest a more complicated biogeographic history: either sebecids represent an extended, independent African lineage previously obscured by pervasive under-sampling, or they signify a Paleogene emigration of European taxa to Gondwana.

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[Talk] [non-student]

The Middle Devonian tetrapod trackways predating their body fossil finds

Grzegorz Niedźwiedzki[1,*] & Per E. Ahlberg[1]

[1] Evolution and Development, Department of Organismal Biology, Uppsala University, Uppsala, Sweden;

[*] grzegorz.niedzwiedzki@ebc.uu.se – presenting author

Keywords: Tetrapods, Devonian, trace fossils.

The fossil record of the earliest Tetrapoda consists of body fossils and trackways. Claims of tetrapod trackways predating the body fossils have been treated as controversial with regard to both age and the identity of the track makers. The replacement of elpistostegid fish by tetrapods in the body-fossil record during the Late Devonian has appeared to reflect an evolutionary event, with the elpistostegids as a short-lived 'transitional grade' between fish and tetrapods. This evolutionary scenario contradicts what we have learned from studies of trace fossils. Numerous tetrapod trackways have been described from the late Middle Devonian (mid-late Givetian) continental Valentia Slate Formation of Valentia Island (Ireland) and the early Middle Devonian (mid-Eifelian) marginal marine-lacustrine Wojciechowice Formation of the Holy Cross Mts. (Poland). New findings and studies since 2016 have enriched our knowledge of the diversity of the Middle Devonian tetrapod trace fossil records from both trackway-bearing formations. Important data has also been provided by Late Devonian sites in Greenland, where numerous tetrapod trackways have been found in the stratigraphical intervals with bone beds of the iconic late Fammenian *Ichthyostega* and a newly discovered, terminal Famennian tetrapod fauna. Marginalized or not considered an important source by some studies, fossil trackways of early tetrapods force a radical reassessment of the timing of the fish-tetrapod transition, as well as the completeness of the body fossil record.

Funding: Funding provided by ERC Advanced Grant ERC-2020-ADG 10101963 "*Tetrapod Origin*" (to PEA).

[Talk] [student]

A new Lower Miocene marine mammal assemblage from the Colle della Croce quarry (Feltre, northeastern Italy) and new biostratigraphic insights on the age of the Libàno Sandstone

Francesco Nobile[1,*], Alberto Collareta[1], Eliana Fornaciari[2], Luca Giusberti[2], Vittore Perenzin[3] & Giovanni Bianucci[1]

[1] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;
[2] Dipartimento di Geoscienze, Università di Padova, Padova, Italy;
[3] Museo Civico Archeologico di Feltre, Feltre, Italy;
[*] francesco.nobile@phd.unipi.it – presenting author

Keywords: Cetacea, Odontoceti, Sirenia, systematics, Early Miocene.

The Libàno Sandstone of Veneto (Italy) is historically known for being home to abundant finds of marine vertebrates, especially toothed whales (Cetacea, Odontoceti), which have been collected and studied since the 19th century. The historical fossiliferous sites, stretching the Belluno area, expose coarse-grained sediments that cannot be biostratigraphically constrained, being barren, and are loosely framed within the Lower Miocene. Here, we report on a marine mammal assemblage from the Colle della Croce (CDC) quarry, a newly discovered locality near Feltre. The fine-grained sediments cropping out in the quarry were successfully dated by means of calcareous nannoplankton biostratigraphy to the 20.89–19 Ma time interval, corresponding to the latest Aquitanian – early Burdigalian. This also allowed for better pinpointing the time of deposition of the Libàno Sandstone to the uppermost Aquitanian.

A preliminary systematic assessment of the marine mammals from the CDC reveals a fairly diverse assemblage of odontocetes, among which the following taxa were identified: a new squaloziphiid-like form, an indeterminate physeteroid (sperm whale), at least two eurhinodelphinid species, an indeterminate member of the clade Platanidelphidi, a form possibly related to *Dalpiazina*, and the basal delphinidan *Kentriodon* sp. Sirenians are also present with a single skeleton that provides the first sea cow record from the Libàno Sandstone.

This new odontocete assemblage is somewhat similar to the historical Belluno fossil fauna given the shared occurrence of squalodontids, eurhinodelphinids, physeteroids and – possibly – dalpiazinids. Apparent idiosyncracies of the CDC fauna include the occurrences of a kentriodontid, a squaloziphiid, and a sirenian, whose absence from the Belluno fauna may be due to minor palaeoenvironmental differences.

[Talk] [student]

Virtual endocast of *Hoplitomeryx matthei* (Artiodactyla, Hoplitomerycidae) and brain evolution in insular ruminants

Pierre Orgebin[1,2,*], Alexandra A.E. van der Geer[3], George Lyras[4], Bastien Mennecart[5], Grégoire Métais[6] & Roberto Rozzi[1,2]

[1] Zentralmagazin Naturwissenschaftlicher Sammlungen, Martin Luther University Halle Wittenberg, Halle (Saale), Germany;
[2] Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[3] Naturalis Biodiversity Center, Leiden, The Netherlands;
[4] Faculty of Geology and Geoenvironment, National and Kapodistrian University of Athens, Athens, Greece;
[5] Naturhistorisches Museum Basel, Basel, Switzerland;
[6] CR2P - Centre de Recherche en Paléontologie, Paris, France;
[*] pierreorgebin3001@gmail.com – presenting author

Keywords: Ruminantia, endocast, geometric morphometrics, Miocene, island evolution.

Mammals often follow peculiar evolutionary trajectories on islands, with some insular large mammals exhibiting reduced relative brain size. However, the antiquity of this phenomenon remains unclear. Here, we report the first digital endocast of an insular artiodactyl, the five-horned ruminant *Hoplitomeryx* from the Late Miocene Gargano palaeo-island (Apulia, Italy). We compare its brain morphology with that of extant and extinct relatives, including the early bovid *Eotragus* and the Middle Miocene cervid *Euprox*, and investigate endocranial size and shape variation across 35 ruminant species. *Hoplitomeryx matthei* displays a derived pecoran brain morphology, similar to that of bovids, suggesting that its ancestor colonised Gargano no earlier than the Early Miocene. This is further supported by its encephalization quotient and the presence of a prominent marginal pole at the top of its endocasts, also found in some Caprini. However, unlike the Balearian mouse goat *Myotragus balearicus*, *Hoplitomeryx matthei* does

not exhibit a reduced occipital region of the neocortex or olfactory bulbs. Instead, it underwent only a minor brain size reduction, highlighting distinct pathways of brain evolution in different island ecosystems. Our study provides new insights into the biogeographic history of *Hoplitomeryx* and the palaeoneuroanatomy of insular mammals before the Quaternary.

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[Talk] [student]

Ontogenetic changes and occlusal efficiency in conodonts

Katja Oselj[1,*], Luka Gale[1,2], Tea Kolar-Jurkovšek[1], Bogdan Jurkovšek[1] & Carlos Martínez-Pérez[3,4]

[1] Geological Survey of Slovenia, Ljubljana, Slovenia;

[2] Faculty of Natural Sciences and Engineering, Department of Geology, Ljubljana, Slovenia;

[3] Cavanilles Institute of Biodiversity & Evolutionary Biology, University of Valencia, Valencia, Spain;

[4] School of Earth Sciences, University of Bristol, Bristol, United Kingdom;

[*] katja.oselj@geo-zs.si – presenting author

Keywords: Wear, occlusion models, ontogenetic stages.

Conodonts were a crucial component of marine environments from the Late Cambrian to the Late Triassic. However, their role in trophic chains remains poorly understood due to the incomplete knowledge of their feeding apparatuses. In recent decades, advancements in analytical techniques—such as computed tomography—have enabled researchers to investigate their functional efficiency using a multidisciplinary approach, including occlusal, microwear, microstructure, and biomechanical analyses. Nonetheless, most studies have focused predominantly on adult forms, where the characteristic morphological features are fully developed. Interestingly, conodont P_1 elements undergo substantial morphological changes throughout ontogenetic development, suggesting that functional efficiency may vary across lifespan. These changes could reflect dietary shifts or, at the very least, variations in how food particles are processed. In this study, we investigate the functional efficiency of the well-known P_1 elements of the Middle Triassic conodont *Pseudofurnishius murcianus*, which exhibits significant morphological variation throughout ontogeny. To achieve this, we analyzed 24 clusters at different ontogenetic stages by constructing 3D occlusal models after scanning them with the synchrotron X-ray tomographic microscope at the Paul Scherrer Institute (Switzerland). To validate our occlusal models, we also examined wear patterns on the blade and platform across three ontogenetic stages using SEM surface analysis on 69 isolated

elements from the same stratigraphic levels. Our preliminary analysis indicates that the occlusal efficiency of P_1 elements increases throughout ontogeny, characterized by a greater number of developed denticles and an expanded platform surface. This configuration reduces lateral movement and constrains the occlusal cycle, effectively transferring loads to food particles. This trend is also reflected in the dental wear patterns: in adult specimens, 78.39% of teeth exhibit wear, compared to 66.66% in juveniles. As individuals mature, wear becomes increasingly concentrated in the central region of the element, coinciding with the increased morphological complexity of their platforms. These findings suggest an improvement in mechanical efficiency over ontogeny. However, further research is needed to determine whether these functional changes result solely from improved food processing efficiency or if they reflect dietary shifts. Such insights will enhance our understanding of the trophic positioning of *Pseudofurnishius murcianus* and clarify whether its ecological role evolved throughout ontogeny.

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[Talk] [student]

Short-term dietary patterns in woolly rhinoceros (*Coelodonta antiquitatis*): insights from Starunia and surrounding regions

Oliwia Oszczepalińska[1,*], Florent Rivals[2,3,4] & Nina Kowalik[1]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, Spain;

[3] Institut Català de Paleoecologia Humana i Evolució Social (IPHES-CERCA), Tarragona, Spain;

[4] Departament d'Història i Història de l'Art, Universitat Rovira i Virgili, Tarragona, Spain;

[*] oszczepalinska@isez.pan.krakow.pl – presenting author

Keywords: Dental microwear, *Coelodonta antiquitatis*, Poland, Ukraine.

The woolly rhinoceros (*Coelodonta antiquitatis*) was a key megaherbivore of Late Pleistocene Eurasia, commonly associated with cold, open steppe-tundra environments. Its morphology suggests adaptations to grazing, and previous interpretations have often described it as a specialized grass-eater. This study examines short-term dietary patterns in woolly rhinoceros based on second molars from six individuals found at four Late Pleistocene sites in southern Poland and western Ukraine. The sample includes three exceptionally well-preserved specimens from the palaeontological site at Starunia, along with material from Deszczowa Cave, Torki near Medyka, and the Radłów quarry.

Microwear patterns were analyzed quantitatively using low-magnification stereomicroscopy, focusing on the number of pits and scratches on occlusal surfaces. The results consistently fall within the range of mixed feeders with browsing tendencies. No specimen exhibits the scratch-dominated pattern typical of grazers. The Starunia individuals, including the nearly complete second rhinoceros, show balanced ratios of pits to scratches, suggesting flexible foraging behaviour. Slight variation between individuals may reflect seasonal or local environmental

differences in vegetation structure. Notably, the Deszczowa specimen displayed the most complex wear pattern.

Overall, the findings support the interpretation of *Coelodonta antiquitatis* as a dietary generalist capable of exploiting a range of herbaceous and shrubby vegetation within open, cold-adapted environments. The microwear signals align with palaeobotanical evidence from Starunia, pointing to a mosaic habitat composed of tundra-steppe and wetland elements. This study highlights the ecological plasticity of the woolly rhinoceros and underscores the value of microwear analysis in reconstructing feeding strategies of extinct megaherbivores in dynamic Late Pleistocene landscapes.

[Poster] [student]

Osteometric variability in Late Pleistocene reindeer (*Rangifer tarandus*) from Moravia

Oliwia Oszczepalińska[1,*], Martina Roblíčková[2], Anna-Kaisa Salmi[3] & Kjetil Lysne Voje[4]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Moravian Museum, Anthropos Institute, Brno, Czech Republic;

[3] History, Culture and Communication Studies, University of Oulu, Finland;

[4] Natural History Museum, University of Oslo, Oslo, Norway;

[*] oszczepalinska@isez.pan.krakow.pl – presenting author

Keywords: Metapodial morphology, mobility patterns, *Rangifer tarandus*, Moravia.

Reindeer (*Rangifer tarandus*) played a key role in the lives of hunter-gatherer communities in Central Europe, serving as a primary source of food and raw materials. This study examines the morphological variability of reindeer metacarpals and metatarsals from three Late Pleistocene sites in Moravia: Pavlov I, Dolní Věstonice II, and Předmostí. These localities are known for rich Pleistocene megafauna remains. The analysis focuses on osteometric measurements of the proximal and distal ends of metapodial bones, which are often preserved in the fossil record and are functionally important for interpreting locomotor adaptations.

To place the fossil data in an ecological context, we applied classification models based on a reference dataset of modern reindeer populations with known habitat types (open vs. closed) and mobility strategies (migratory vs. sedentary). These models helped determine the most likely ecological classification of the fossil specimens. The results indicate that most of the analyzed individuals show morphological traits typical of migratory reindeer adapted to open environments such as tundra or steppe.

The results improve our understanding of reindeer mobility, landscape use, and the availability of faunal resources. Further integration with isotopic analyses may offer deeper insight into the ecological adaptations of Late Pleistocene reindeer.

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[Talk] [non-student]

How to survive a winter? Life and death of *Tarbosaurus bataar* (Dinosauria, Theropoda) from the Late Cretaceous ecosystems of Asia

Krzysztof Owocki[1,*], Hervé Bocherens[2,3] & Grzegorz Niedźwiedzki[4,5]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[2] Department of Geosciences, University of Tübingen, Tübingen, Germany;

[3] Senckenberg Centre for Human Evolution and Palaeoenvironment, Tübingen, Germany;

[4] Department of Organismal Biology, Evolutionary Biology Centre, Uppsala University, Uppsala, Sweden;

[5] Polish Geological Institute, National Research Institute, Warsaw, Poland;

[*] owocki@twrada.pan.pl – presenting author

Keywords: Stable isotopes, strontium isotopes, palaeoecology, dinosaurs.

The tyrannosaurid *Tarbosaurus bataar* was one of the largest theropod dinosaur in the Late Cretaceous terrestrial ecosystems of Laurasia. The biology and ecology of this giant predator is still poorly understood, although there are many speculations about the lifestyle of large tyrannosaurids. New geochemical approaches to the study of vertebrate palaeoecology have renewed interest in trophic structure studies and in determining migratory patterns in dinosaurs. In this study, we report a detailed carbon, oxygen, and strontium isotopic evidence from the fossil enamel record, which elucidates the patterns of dietary preferences and migratory movements of several *Tarbosaurus* individuals collected from the same beds of the Nemegt Basin in southern Mongolia. The stable carbon results suggest that *Tarbosaurus* modified their dietary preferences during ontogeny. The strontium isotopes signatures indicate that they may have been territorial predators, non-migratory and hunting in one area. Taphonomic, geochemical, and histological observations indicate that most of the sampled *Tarbosaurus*

individuals died during the winter period in the Nemegt Basin, probably as a result of malnutrition. This has interesting ecological implications and may explain the overrepresentation of skeletal remains of these large predators in the Nemegt sections. These results highlight the complexities of dietary and territorial behavior by *Tarbosaurus* individuals to stabilisation in the availability of food resources.

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[Poster] [student]

New insights into Anatolian snake fauna at the Paleogene-Neogene transition

Václav Paclík[1,2,*] & Martin Ivanov[2]

[1] South Moravian Museum in Znojmo, Znojmo, Czech Republic;

[2] Department of Geological Sciences, Faculty of Science, Masaryk University, Brno, Czech Republic;

[*] geologie@muzeumznojmo.cz – presenting author

Keywords: Serpentes, Anatolia, Kargı, Oligocene, Miocene.

The latest Oligocene to earliest Miocene transition is generally poorly represented in the fossil record of snakes throughout Eurasia. Although the palaeogeographic evolution around the Paratethyan and Mediterranean Seas enabled faunal exchanges between Anatolia and southeastern Europe during the latest Oligocene and earliest Miocene (MP 30 to MN 1–2), there are only three localities that could partially substantiate this communication in herpetofauna – Kucuran, Kilçak, and Kargı. Among these, Kargı 1–3 has yielded diverse amphibian and reptile communities. However, snakes from Kargı have not been adequately studied in detail. We here focused on the study of snakes from two Kargı localities, Kargı 1 (MN 1) and Kargı 2 (MP 30/MN 1). Although most vertebrae are poorly preserved, hindering a precise determination, we identified six different snake taxa in Kargı 1 (*Eoanilius* aff. *oligocenicus*, cf. *Falseryx* sp., *Platyspondylia* sp., Alethinophidia indet. 1, and Colubroidea indet. 1 and 2) and four taxa in Kargı 2 (*Eoanilius* aff. *oligocenicus*, cf. *Falseryx* sp., *Platyspondylia* sp., and Colubroidea indet. 1). *Eoanilius* aff. *oligocenicus*, cf. *Falseryx* sp., and *Platyspondylia* sp. resemble those reported in several European localities. *Eoanilius* aff. *oligocenicus* differs from the type material of *E. oligocenicus* by the more anteriorly extended neural spine and more distinct haemal keel. Trunk vertebrae of cf. *Falseryx* sp. differ those of *Falseryx petersbuchi* and *Falseryx neervelpensis* by a slightly longer neural spine, but cloacal and caudal (including posterior caudal) vertebrae, clearly referable to same form as the trunk vertebrae, possess hypapophysis instead of haemapophyses. Colubroidea are represented by two indeterminate morphotypes of which

Colubroidea indet. 1 displays paracotylar foramina in the trunk portion of the vertebral column but all caudal vertebrae have developed bilaterally doubled paracotylar foramina. This taxon occurs in both localities. The only trunk vertebra of Colubroidea indet. 2 differs from Colubroidea indet. 1 by the presence of markedly long subcotylar tubercles. Snakes from Kargı 1 and Kargı 2, which do not substantially differ from the known scarce record of Oligo-Miocene snakes from Anatolia, display a close affinity to European late Paleogene snakes and therefore, faunal exchanges between both areas seem probable around the Oligocene-Miocene transition. These new finds are important not only for the understanding of the morphological variability within the vertebral column of selected snake groups but also provide us new information about the evolution of snake communities around the Paleogene–Neogene transition.

Funding: This project was supported by the Specific Research Project at the Faculty of Science, Masaryk University in Brno.

[Talk] [non-student]

Palaeoenvironment and trophic structure of the Late Triassic vertebrate-bearing Poręba site (Upper Silesia, Poland)

Grzegorz Pacyna[1,*], Anna Fijałkowska-Mader[2] & Tomasz Sulej[3]

[1] Department of Taxonomy, Phytogeography and Paleobotany, Institute of Botany, Faculty of Biology, Jagiellonian University, Kraków, Poland;
[2] Polish Geological Institute – National Research Institute, Holy Cross Branch, Kielce, Poland;
[3] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[*] grzegorz.pacyna@uj.edu.pl – presenting author

Keywords: Plant-animal interactions, herbivory, coprolites, dinosaurs.

Poręba is a Late Triassic plant- and vertebrate-bone-bearing locality in south-western Poland. Beds exposed at Poręba include conglomerates, grey to yellowish sandstones, grey to bluish claystones and siltstones and bone-bearing breccia horizons (referred to as the "Lisów Breccia"). The strata belong to the upper part of the Patoka Member of the Grabowa Formation. They represent a braided river system periodically variable in flow energy, with episodes of high flow energy (conglomerates) interchanging with lower flow regimes (claystones and siltstones) caused by monsoonal-climate dry and wet seasons. Numerous sporomorphs found in fossil-bearing levels are typical for the local zone *Classopollis meyeriana* subzone b, pointing to middle–late Norian age. Vertebrate bones are preserved mainly in conglomerates and claystones, and plant remains in claystones and siltstones. Both types of fossils were transported over quite a long distance. The vertebrate assemblage consists of freshwater, semiaquatic and land animals, including, sharks, actinopterygians, dipnoans, temnospondyls, turtles, and various group of archosauromorphs, such as aetosaurs, silesaurids, and dinosaurs. Bones of one of the oldest European turtles, *Proterochersis porebensis*, are most often found. Plant macroremains belong almost exclusively to conifers. *Brachyphyllum-Pagiophyllum* leafy shoots predominate, associated with isolated female seed scale-bract scale complexes and isolated male cones from at least three genera. As reproductive structures and sterile remains are not preserved in organic connection, it is very difficult to correlate them and reconstruct whole plants. Numerous plant-

animal interactions were identified on plant leaves. Charcoal particles (mainly charcoaled coniferous wood of *Agathoxylon keuperianum*) are very frequent and point to regular forest fires. Common finds are vertebrate coprolites containing plant and animal cuticles, tracheids, parasitic invertebrate eggs and bone remains. The mesofossil assemblage includes, besides plant remains, also rare invertebrate cuticles (including beetles and possible scorpions) and diversified clitellate cocoons. A large part of the trophic pyramid was based on production in water (sharks, actinopterygians, dipnoans, temnospondyls, turtles, possibly some predatory archosauromorphs). Tough-leaved conifers formed the nutritional basis of terrestrial herbivores (and some omnivores), as judged from the plant remains from the coprolites, but some ferns, lycopsids, and sphenopsids were present based on palynological data; this is consistent with a river paleoenvironment. Some of these plant groups may have been food for animals that was completely digested and not preserved in coprolites. All data gathered so far point to complex biotic interactions in ecosystems that are already approaching the modern structure.

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[Talk] [non-student]

Unveiling postcranial variability in the extinct Sicilian *Hippopotamus*: implications for taxonomy and palaeoecology

Luca Pandolfi[1,*], Mirko Di Febbraro[2], Pasquale Raia[3] & Roberta Martino[4,5]

[1] Dipartimento di Scienze della Terra, Università di Pisa, Pisa, Italy;

[2] EnviX-Lab, Dipartimento di Bioscienze e Territorio, Università degli Studi del Molise, Pesche, Italy;

[3] Dipartimento di Scienze della Terra, dell'Ambiente e delle Risorse, Università di Napoli Federico II, Napoli, Italy;

[4] GEOBIOTEC, Department of Earth Sciencies, NOVA School of Science and Technology, Universidade NOVA de Lisboa, Caparica, Portugal;

[5] Museu da Lourinhã, Lourinhã, Portugal;

[*] luca.pandolfi1@unipi.it – presenting author

Keywords: Morphology, Morphometry, Variability, Quaternary, Italy.

Abundant Quaternary hippopotamid fossils from the Mediterranean islands of Sicily, Malta, Cyprus, and Crete led to the identification of several endemic species, including *Hippopotamus pentlandi* from Sicily, frequently associated with the endemic *Palaeoloxodon mnaidriensis* in its numerous fossiliferous sites. Despite these extensive records, ~50 localities, detailed systematic studies on *Hippopotamus pentlandi* remain limited, leading investigations into the potential presence of *Hippopotamus amphibius* in some Sicilian localities. This study addresses this gap through morphological and morphometric analysis of postcranial hippopotamid remains from San Ciro Cave (Palermo, Italy). The aim is to test the hypothesis of *Hippopotamus amphibius*'s occurrence and to gain insights into the Sicilian hippopotamus's postcranial adaptations and locomotion, crucial for understanding past palaeoenvironments.

Our findings reveal that San Ciro humeri exhibit morphological similarities to both *Hippopotamus amphibius* and *Hippopotamus pentlandi* from Cannita Cave, yet their measurements align more closely with the larger *Hippopotamus amphibius*. Similarly, the robust radius-ulna and olecranon-radius angle resemble the extant species. In contrast, the

robust femora and tibiae, with their broad epiphyses, show morphometric affinities towards the insular *Hippopotamus pentlandi*, although some overlap with *Hippopotamus amphibius* exists. Astragali from San Ciro fall within the size range of both species. Postcranial body mass estimations, validated against extant *Hippopotamus amphibius*, suggest a considerable size for San Ciro specimens (1343–1896 kg) and *Hippopotamus pentlandi* for Cannita Cave (910–1814 kg), indicating a substantial body size for the endemic Sicilian hippopotamus, and potentially excluding the San Ciro specimens from the smaller size range reported for other endemic hippopotamid species, warranting further investigation into their taxonomic affinities.

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[Talk] [student]

The most complete cranial anatomy of a fossil ginglymodian (Actinopterygii) revealed by a new fish specimen from the Late Triassic of Krasiejów (Poland)

Wojciech Pawlak[1,*]

[1] Institute of Evolutionary Biology, Faculty of Biology, Biological and Chemical Research Centre, University of Warsaw, Poland;
[*] wojciech.pawlak@uw.edu.pl – presenting author

Keywords: Actinopterygii, comparative anatomy, computed tomography, Krasiejów, Triassic.

The diversification of ray-finned fish (Actinopterygii) during the Triassic led to the emergence and radiation of numerous lineages that came to dominate aquatic ecosystems in the Mesozoic, including extant Teleostei, Halecomorphi, and Ginglymodi. However, the understanding of this evolutionary process is severely hampered by the poor preservation of fossils, which are often compacted and give limited access to internal skeletal structures. The most comprehensive anatomical information to date has been provided by Early Triassic, three-dimensionally preserved taxa such as *Pteronisculus* and *Watsonulus*. Their detailed osteological reconstructions have served as key references for many subsequent studies of less complete fossils of Mesozoic ray-finned fish. Nonetheless, their comparative value is limited, as they represent only a narrow part of the ray-finned fish tree of life.

Here, I report a newly discovered, nearly complete, three-dimensionally preserved actinopterygian individual from the Late Triassic Krasiejów site in Poland. While this locality is frequently reported in the literature as a mass fossil accumulation (e.g., bivalves, crustaceans, lungfish, temnospondyls, and archosaurs), ray-finned fish were previously known mainly from isolated microfossils and tentative interpretations of more complete remains. The studied specimen was examined using non-destructive computed tomography, enabling detailed visualization of fragile and complex structures. These include the lateral dermal skull cover, braincase, suspensorium, jaws, gill basket, opercular apparatus, pectoral girdle, and fragments

of the rostral region and skull roof. Remarkably, the specimen revealed preservation of soft-tissue-derived structures associated with bones, such as cartilages and ligamentous connections. The anatomical features of the infraorbital series, braincase, and suspensorium indicate that the specimen belongs to Ginglymodi - a clade comprising extant gars and a variety of extinct species ranging from opportunistic to highly specialized forms inhabiting freshwater to marine environments. The specimen from Krasiejów is the first extinct ginglymodian to be reconstructed using computed tomography, revealing a nearly complete and intact skull structure. Therefore, it provides a new window into the cranial anatomy of Triassic actinopterygians, offering data on skeletal anatomy of a quality comparable to that of living species.

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[Poster] [non-student]

Images of woolly rhinoceroses in Paleolithic art in Eurasia

Kamilla Pawłowska[1,*], Kajetan Dedła[2], Zofia Pogoda[3], Roman Croitor[4], Thijs van Kolfschoten[5,6], Diego Jaime Alvarez Lao[7] & Vlad Codrea[8]

[1] Institute of Geology, Adam Mickiewicz University, Poznań, Poland;

[2] Institute of Geology, Adam Mickiewicz University, Poznań, Poland;

[3] Faculty of Fine Arts, Institute of Conservation and Restoration of Works of Art, Nicolaus Copernicus University in Toruń, Poland;

[4] Ministry of Culture, Education, and Research, Institute of Zoology, Chișinău, Moldova;

[5] Faculty of Archaeology, Leiden University, The Netherlands;

[6] Joint International Research Laboratory of Environment and Social Archaeology, Shandong University, Qingdao, China;

[7] Department of Geology, University of Oviedo, Spain;

[8] Faculty of Biology and Geology, Babes-Bolyai University Cluj-Napoca, Romania;

[*] koka@amu.edu.pl – presenting author

Keywords: *Coelodonta*, Pleistocene, Poland.

In this work, we focus on art featuring woolly rhinoceroses (*Coelodonta*) from Eurasia. A review of 400 sites from Eurasia at which Paleolithic art was found made it possible to identify sites at which there are cases of depictions of rhinoceroses. We will provide an overview of cave paintings in terms of (i) geographic scope, (ii) chronology, (iii) representation, (iv) creator and associated fauna. Evidence comes from France, Belgium, Czech Republic, Germany, Slovakia, Spain, Romania, and Russia and is attributed to the Aurignacian, Gravettian, Solutrean, and Magdalenian cultures. The woolly rhinoceros co-occurs with other mammals such as woolly mammoths, bison, lions and others. The rhinoceroses are shown superficially as an outline and in detail with a hump, with a black stripe, bleeding, or fighting one. These paintings of woolly rhinoceroses can be linked to modern humans who used coal, ochre and manganese to represent them in the artworks.

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[Poster] [student]

Thermal palaeobiophysics: body temperature inferences for *Thalattosuchus superciliosus* (Crocodylomorpha, Thalattosuchia)

Romain Pellarin[1,*], Isabelle Vallet[2], Georges Gerolymos[2] & Eric Brunet[3]

[1] Centre de Recherche en Paléontologie - Paris, Sorbonne-Université, Paris France;

[2] Institut Jean le Rond d'Alembert, Sorbonne Université, Paris, France;

[3] Laboratoire de Physique de l'ENS; Ecole Normale Supérieure & Sorbonne-Université, Paris, France;

[*] romain.pellarin@etu.sorbonne-universite.fr – presenting author

Keywords: Metriorhynchidae, *Thalattosuchus*, Thermophysiology.

Metriorhynchidae (Crocodylomorpha) was the only clade within Archosauria to operate a transition to the fully pelagic lifestyle. A recent study of their physiology concluded that, despite this unique lifestyle, the metriorhynchid *Thalattosuchus superciliosus* was ectothermic like extant semi-aquatic crocodilians by showing a low resting (RMR) and maximal metabolic rates (MMR). Here, we provide new analysis concerning body temperature inferences for this species, with the use of a thermal physics-based approach. The power output of a specimen has been computed using the published values of RMR and MMR, the energy released by metabolite degradation, and its supposed mass and surfaces. Approximating the crocodile as a prolate spheroid, Reynolds-analogy-based correlations were used to estimate the convective heat transfer coefficient as a function of local skin-friction. Finally, assuming the thickness of the tissue layers inside the body of *Thalattosuchus superciliosus*, we estimated the thermal gradient (ΔT) between the core of the organism and ambient temperature. We inferred thermal gradients as $\Delta T_{rest} \approx 2°C$ at rest, and $\Delta T_{active} \approx 11°C$ during intense activity phases, between the body core and the ambient temperature. The ΔT_{rest} result is consistent with body temperature of extant emerged crocodilians, and in agreement with the recent assessment of *Thalattosuchus superciliosus* body temperature by isotopic geochemical approaches. However, this represents a very approximate approach, as a first step for body temperature inferences with the use of thermal physics for fossil taxa, gives order of magnitude results and still requires refinement.

[Talk] [non-student]

Jurassic teleost diversity and abundance changes as documented by otolith assemblages

Maciej K. Pindakiewicz[1,*], Krzysztof Hryniewicz[1], Simona Rinkevičiūtė[2], Przemysław Sztajner[3], Katarzyna Janiszewska[1] & Andrzej Kaim[1]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[2] Department of Geology and Mineralogy, Faculty of Chemistry and Geosciences, Vilnius University, Vilnius, Lithuania;

[3] Institute of Marine and Environmental Sciences, University of Szczecin, Szczecin, Poland;

[*] presenting author – mpindakiewicz@twarda.pan.pl

Keywords: Otoliths, Holosteans, Albuliformes, Elopiformes, Leptolepiformes.

We describe otolith (plus cephalopod) statolith assemblages from the Jurassic of Lithuania, Poland, and the United Kingdom. We report two new teleost fish genera (*Juraelops* and *Vodyanoi*), and eight new fish species (*Pteralbula jurassica*, *Protalbula dorsetensis*, *Palealbula ventai*, *Palealbula crenulata*, *Juraelops prodigiosum*, *Vodyanoi schwarzhansi*, *Vodyanoi stringeri*, and *Archaeotolithus solidus*). We compare the amount of cephalopod statoliths with teleost otoliths from the same localities. We find significant dominance of basal decabrachians over bony fish in nearly all investigated assemblages. We established that Mesozoic cephalopod statoliths belong to relatives of belemnoids or idiosepiids. We find significant dominance of by leptolepiforms within teleost otoliths from Early and Middle Jurassic localities. Within those localities we found otoliths of putative holosteans. Marine holosteans were represented only by the otolith genus *Archaeotolithus.* Similar to leptolepiforms, the peak of their diversity occurred in the Early Jurassic. Species of *Archaeotolithus* are divided into two morphotypes. Based on our findings, we propose that crown-teleosts diversified during the Middle Jurassic and that their radiation started in the Late Jurassic. That radiation affected mostly Albuliformes and Elopiformes, with their peak at the Kimmeridgian. We found also singular otoliths of the

osteoglossiform genus *Kokenichthys*. The shift between statolith-to-otolith abundance ratios in the investigated assemblages documents a change from a cephalopod-dominated nekton during the Jurassic to a mostly teleost-dominated nekton during the Cretaceous. We propose that this change started as early as during the latest Jurassic. We theorized that the shift of abundance between cephalopods and teleosts could be caused by spreading of Atlantic Ocean, or the gradual radiation of teleosts, or by combination of both events.

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[Poster] [student]

Structure and functions of the teeth of the Triassic reptile *Nothosaurus* (Sauropterygia)

Joanna Piwowarczyk[1,*], Wojciech Pawlak[1] & Mateusz Tałanda[1]

[1] Institute of Biology Evolution, University of Warsaw, Warsaw, Poland;
[*] j.puchalla@student.uw.edu.pl – presenting author

Keywords: *Nothosaurus*, dentition, histology, functional anatomy, biomechanics.

Nothosaurus is a Triassic marine reptile found in Europe, Asia, North America, and (more recently discovered also in) New Zealand, ranging from the Anisian to Carnian (246–237 Ma). Despite many studies on this genus skull, its dentition has poorly recognized histological structures. The diet of *Nothosaurus* is largely obscure despite being a major component of the Middle Triassic trophic webs. This uncertainty is mainly due to lack of direct evidence of digested content, and conclusive functional analyses regarding its feeding apparatus. The up-to-date hypotheses (non-mutually exclusive) suggest feeding on fish, soft-bodied cephalopods, smaller marine reptiles, or even larger tanystropheids. A general appearance of *Nothosaurus* dentition composed of simple slender teeth protruding beyond the oral chamber indicate a primarily fish-oriented diet, something that has been stressed by some authors. The same authors tend to point that they may have been too fragile to capture hard-bodied prey. The piscivorous diet and teeth fragility are contradictory hypotheses in the context of ganoine-covered fish dominating the Triassic aquatic biomes. Here we present preliminary results of the functional analysis of *Nothosaurus* teeth based on morphological and histological redescription that will be followed by biomechanical analysis. We reveal the presence of folded dentine (plicidentine), regarded as generally absent in Sauropterygia but present in numerous other vertebrates, including ones related with aquatic habitats such as temnospondyl amphibians and ichthyosaurs. The identified dentine infolds are structurally related with a deep apicobasal grooving characteristic for the external surface of *Nothosaurus* teeth. Functional significance of the plicidentine as well as the external grooving remains still unknown. In order to explore this topic, static and dynamic biomechanical analyses are further planned.

[Talk] [non-student]

Updating the Miocene Polish fossil record: new terrestrial vertebrate localities from the Serravallian (Middle Miocene) of the Holy Cross Mountains

Yohan Pochat-Cottilloux[1,*], Marcin Górka[2], Sergi López-Torres[1] & Mateusz Tałanda[1]

[1] Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland;

[2] Faculty of Geology, University of Warsaw, Warsaw, Poland;

* y.pochat-cottilloux@uw.edu.pl – presenting author

Keywords: Miocene, vertebrates, Poland, Paratethys, palaeobiogeography.

During the Miocene, major climatic changes impacted terrestrial vertebrate faunas, across Africa and Eurasia, such as the Middle Miocene Climatic Optimum event. The higher temperatures associated with this event allowed some groups of more thermophilic organisms, such as reptiles or amphibians, to have a much wider geographic distribution. In this time, central Eurasia was covered by a huge sea called Paratethys, which acted as a barrier for the dispersal of such terrestrial animals. Unfortunately, the role of the northern coast of the Central Paratethys in affecting those mechanisms is currently not well understood. This is mainly due to poor sampling of that area with only a few localities known from central and southern Poland, as well as northern Ukraine. Here, we present new occurrences and data from recently discovered localities in Poland, aiming at filling this gap. Of special interest are turtle (Trionychidae and Testudinidae), crocodile, squamate (Lacertidae, Anguidae, and Colubriformes), amphibian (Discoglossidae) and mammalian (Eulipotyphla and Moschidae) remains. These new and future results will directly impact our knowledge of Miocene paleobiogeography, contributing to the broader understanding of the climate system and faunal dispersals of this epoch. Indeed, the presence of thermophilic taxa in the Polish Miocene opens the possibility of a more northern dispersal route between Europe and Asia.

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[Poster] [non-student]

Size is the major driver of the endosseous labyrinth shape in extant crocodylians

Yohan Pochat-Cottilloux[1,2,*], Gwendal Perrichon[1], Lionel Hautier[3,4], Nicolas Rinder[1], Romain Amiot[1], Irena Raselli[5,6], Jérôme Adrien[7], Joël Lachambre[7], Vincent Fernandez[8,9] & Jeremy E. Martin[1]

[1] University of Lyon, University of Lyon 1, ENSL, CNRS, LGL-TPE, Villeurbanne, France ;
[2] Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw, Warsaw, Poland;
[3] Institut des Sciences de l'Evolution de Montpellier (ISEM), University of Montpellier, CNRS, IRD, Montpellier, France;
[4] Natural History Museum of London, Mammal Section, Department of Life Sciences, London, United Kingdom;
[5] Jurassica Museum, Porrentruy, Switzerland;
[6] Geosciences Department, University of Fribourg, Fribourg, Switzerland;
[7] INSA-Lyon, MATEIS UMR CNRS 5510, University of Lyon, Villeurbanne, France;
[8] European Synchrotron Radiation Facility, Grenoble, France;
[9] Imaging and Analysis Centre, The Natural History Museum, London, United Kingdom;
[*] y.pochat-cottilloux@uw.edu.pl – presenting author

Keywords: Crocodylia, 3D geometric morphometrics, CT scan, endosseous labyrinths, ontogeny.

The endosseous labyrinth plays a critical role in hearing and spatial orientation. Over their evolutionary history, Crocodylomorpha have adapted to a wide range of environments, and the morphology of their labyrinths has been proposed as an indicator of ecological lifestyle. However, the influence of ontogeny and phylogeny on labyrinth shape remains poorly understood, largely due to limitations in dataset size and scope. In this study, we present the most comprehensive dataset to date, comprising 111 specimens from 22 extant crocodylian

species, spanning various developmental stages from hatchlings to adults. Through 3D geometric morphometrics, we demonstrate that allometry is the primary driver of labyrinth shape variation across all modern genera, likely reflecting changes in braincase morphology during growth. A moderate phylogenetic signal is detected, but it becomes negligible once size is accounted for, suggesting it does not correspond to consistent, discrete morphological traits. These findings highlight the challenges of incorporating fossil taxa with divergent ecologies into comparative analyses and underscore the need for caution when inferring lifestyle from inner ear morphology alone.

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[Poster] [non-student]

Can heterothermic species be used as indicators of environmental changes? A test using Holocene bat faunas from Poland

Tomasz Postawa[1,*]

[1] Institute of Systematics and Evolution, Animals Polish Academy of Sciences, Krakow, Poland;

[*] tpostawa@gmail.com – presenting author

Keywords: Chiroptera, ecology, Holocene, microclimate, palaeoclimate.

The remains of small vertebrates are considered a significant source of information on environmental changes in the Quaternary. The qualitative and quantitative composition of vertebrate species in the sediment, as well as their contemporary environmental requirements, can be used to approximately reconstruct climatic and environmental conditions during sediment formation. Most of these models are based on rodents, which are the dominant mammal group found in terms of both quality and quantity. Quaternary sediments containing vertebrate faunal remains are, in fact, mostly found in caves, where bats (Chiroptera) are also among the more numerous mammals. Bats represent a highly specialized group with a unique metabolic adaptation called heterothermy. In contrast to rodents, whose remains in cave sediments are likely to originate from outside (e.g., owl pellets), bat remains are most likely to come from individuals who died inside the cave during hibernation or reproduction. The temperature preferences of bat species during hibernation and their foraging strategies during activity provide a reliable indicator for reconstructing climate and environmental parameters.
The species and quantitative composition of 29 Holocene thanatocenoses from caves in the upland and mountain regions of southern Poland were reanalyzed. Palaeozoological dating was then compared with known absolute dates based on y BP (^{14}C). The two methods were found to be compatible in only 25% of cases. In the remaining examples, the differences were between 2,000 and 4,000 years BP (^{14}C). Next, I investigated whether recent winter bat aggregations and active fauna during swarming could be explained by forest communities and average

temperatures. The results suggest that palaeozoological dating of bat thanatocenoses may be subject to considerable error. Paradoxically, this error is caused by the very features that are considered helpful in this type of dating - heterothermy and varied foraging types: i) the absence of certain species from the sediments does not indicate their absence from the environment; it merely suggests that they use other, more thermally optimal shelters; ii) due to the limited number of caves, some species migrate up to several hundred kilometres to reach their wintering locations, which are often distant from their feeding habitats.

[Poster] [non-student]

An Appalachian early-branching hadrosaurid dinosaur from the lower–middle Campanian Coffee Formation of Mississippi, southeastern USA

Derek Hoffman[1], Alyson A. Brink[1,2], George Phillips[3], Logan King[4], James Starnes[5], Nina L. Baghai-Riding[6], Carol L. Hotton[7], Olivia Pharr[6], Dave Hanes[8] & **Albert Prieto-Márquez**[9,10,*]

[1] School of Biological, Environmental and Earth Sciences, University of Southern Mississippi, Hattiesburg, Mississippi, USA;
[2] Vertebrate Paleontology, Sam Noble Museum of Natural History, University of Oklahoma, Norman, Oklahoma, USA;
[3] Mississippi Museum of Natural Science, Jackson, Mississippi, USA;
[4] Colorado Northwestern Community College, Craig, Colorado, USA;
[5] Mississippi Department of Environmental Quality, Office of Geology, Jackson, Mississippi, USA;
[6] Division of Mathematics and Sciences, Delta State University, Cleveland, Mississippi, USA;
[7] Department of Paleobiology, National Museum of Natural History, Washington DC, USA;
[8] Columbia Gem and Mineral Society, Columbia, South Carolina, USA;
[9] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Sabadell, Spain;
[10] Museu de la Conca Dellà, Isona, Spain;
[*] albert.prieto@icp.cat – presenting author

Keywords: Dinosauria, Cretaceous, evolution, Hadrosauridae, Appalachia.

The Late Cretaceous diversity and evolution of non-avian dinosaurs from Appalachia (present-day eastern North America) remains relatively poorly understood. In Mississippi, the fossil record of these animals includes representatives of various theropod and ornithischian clades, known from disarticulated and typically isolated elements recovered from marine deposits within the Coniacian-Maastrichtian Mississippi Embayment. Approximately half of the dinosaur material recovered from the state is attributable to the 'duck-billed' Hadrosauroidea. Here, we report on MMNS VP-12239, from the collections of the Mississippi Museum of

Natural Science, representing a partial hadrosaurid skeleton collected at the Booneville Dinosaur Site, corresponding to the early–mid Campanian Coffee Formation of northeastern Mississippi. The Campanian-aged Coffee Formation consists of glauconitic and clay-rich quartz sands indicative of marginal marine environments, such as lagoons, barrier islands, offshore bars, and surge channels. The Booneville Dinosaur Site is interpreted as a marginal (estuarine) setting based on the predominance of terrestrial pollen and spores mixed with some marine dinoflagellates. MMNS VP-12239 is the most taxonomically significant dinosaur discovery in the state to date, consisting of various axial elements, ulna, humerus and both pubes. Traditional and Procrustes geometric morphometric analyses were conducted on the humerus and pubis to quantitatively compare the morphology of these elements with those of a representative sample of hadrosauroids. The results from the latter analyses showed that the Booneville humerus is most similar to that of non-saurolophid hadrosauroids, whereas the pubis is morphologically more reminiscent of saurolophine hadrosaurids. A parsimony phylogenetic analysis was also conducted to infer the position of MMNS VP-12239 within hadrosauroids. The strict consensus tree showed MMNS VP-12239 as an early-branching hadrosaurid, part of a sequence of progressively closer outgroups of Saurolophidae, the major radiation that includes Saurolophinae and Lambeosaurinae. Notably, that sequence of outgroups also includes the only two hadrosaurid species erected so far in Appalachia, *Eotrachodon orientalis* and *Lophorhothon atopus*, from the uppermost Santonian and lower Campanian strata, respectively, of the Mooreville Chalk in Alabama. Recognition of the Booneville specimen as a basally-branching hadrosaurid is consistent with an Appalachian origin for the clade. In addition, the morphology of MMNS VP-12239 adds to the hypothesis positing that hadrosaurids in Appalachia might have evolved independently from those of other regions, and that the Appalachian dinosaur faunal community was distinct from that of Laramidia.

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[Poster] [non-student]

Osteohistology of pterosaur specimens from the Kimmeridge Clay Formation (Upper Jurassic) of Weymouth, UK

Marta Meléndez[1], Natalia Jagielska[2,3], Albert Sellés[1,4], Heather Middleton[5] & **Albert Prieto-Márquez**[1,4,*]

[1] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Sabadell, Spain;
[2] Chinese University of Hong Kong, ShaTin, Hong Kong, China (SAR);
[3] Lyme Regis Museum, Lyme Regis, United Kingdom;
[4] Museu de la Conca Dellà, Isona, Spain;
[5] Independent researcher, Dorset, United Kingdom;
[*] albert.prieto@icp.cat – presenting author

Keywords: Pterosauria, Rhamphorhynchidae, Jurassic, palaeobiology, Europe.

The Upper Jurassic Kimmeridge Clay Formation (Dorset, UK) is renowned for its rich and diverse vertebrate fossil assemblage. One of the lesser-known localities of the Lower Kimmeridge Clay, Smallmouth Sands (near Portland Harbour, Weymouth), has provided the disarticulated remains of more than 500 elements referred to rhamphorhynchid and monofenestratan pterosaurs. This rich record offers valuable insights into the palaeobiology of Late Jurassic pterosaurs. The present study focuses on eight pterosaur specimens comprising five wing phalanges and three limb diaphyses. Wing phalange diaphyses displays parallel-fibered bone, with local laminar and reticular fibrolamellar tissue. Some secondary osteons are observed close to the medullary cavity, and abundant annuli and LAGs especially occurs near the longitudinal groove in metacarpal IV sections. In two samples, the nutrient foramen is observed, which is generally present in very young individuals. It is worth noting that in one of the samples belonging to wing elements, which shows a poorly vascularized periosteum, deep LAGs are found, and between them, locally, the middle cortical layer consists of loose Haversian bone. Non-wing limb bones exhibit predominant primary fibrolamellar bone tissue, characterized by highly vascularized longitudinal tissue, locally reticular. In contrast, certain

samples exhibit compact lamellar bone with abundant Sharpey's fibers, likely reflecting mature bone tissue from long bone diaphysis. One specimen contains a layer of orderly osteocytes adjacent to the endosteum, interpreted as early bone growth during the first year of life. The presence of EFS in this sample suggest skeletal maturity. All these differences between the samples can indicate different limb elements or even two different species. The histological results suggest that the Smallmouth Sands locality mainly includes juvenile, subadult and adult pterosaur individuals. The bone wall thickness observed is aligned with early pterosaur lineages from the Kimmeridge Clay Formation, which possess thicker bone walls than their Cretaceous counterparts. Histological and size variation in the Smallmouth Sands pterosaur remains supports previously proposed high taxonomic diversity. Further taxonomic resolution and expanded histological sampling of well-identified specimens are necessary to clarify developmental patterns and improve understanding of pterosaur diversity and growth in the Upper Jurassic of southern England.

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[Talk] [student]

Investigating a Devonian vertebrate assemblage with Synchrotron Microtomography of coprolites

Arnaud Rebillard[1,2*], Vincent Dupret[3], Pavel Beznosov[4] & Per Erik Ahlberg[3]

[1] Museum für Naturkunde Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;

[2] Humboldt-Universität zu Berlin, Institut für Biologie, Berlin, Germany;

[3] Department of Organismal Biology, Uppsala University, Uppsala, Sweden;

[4] Institute of Geology, FRC Komi Science Centre, UB of RAS, Komi Republic, Russia;

[*] arnaud.rebillard@mfn.berlin – presenting author

Keywords: Vertebrates, coprolites, tetrapods, bromalites, ichnofossils.

Fossilised faeces (coprolites) are a unique source of information as they record paleontological evidence of animal behaviour (autecology) as well as interactions between extinct organisms and their environment (synecology). Four samples bearing coprolites from a newly discovered vertebrate locality in the Kumushka Formation, dated to the Givetian-Frasnian transitional interval of the Devonian sequence of North Timan (Northeastern Europe), were scanned using propagation phase-contrast synchrotron microtomography. A total of seven coprolites were recovered and segmented to digitally extract their entire content. The high-quality three-dimensional preservation of the inclusions allowed for their anatomical and taxonomic identification. Fleurantiid-like lungfish and acanthodian remains are abundantly found in each specimen, along with fewer immature holoptychiid elements. The contents of the coprolites indicate an opportunistic feeding behaviour, with remains from multiple trophic levels present across the different samples. The size of some remains reveals feeding on juveniles. The taxa preserved within the studied coprolites and [separately] as body fossil remains, are placed in a trophic pyramid, providing evidence for the early establishment of a complex multi-level trophic chain at the Givetian–Frasnian boundary.

[Talk] [non-student]

Zooarchaeological and isotopic study of animal remains from the Late Bronze Age site of Ridala, Saaremaa Island, Estonia

Joanna Religa-Sobczyk[1,*], Piotr Wojtal[1], Nina Kowalik[1], Sylwia Pospuła[1], Lembi Lõugas[2,3], Christoph Spötl[4], Teresa Tomek[1] & Krzysztof Wertz[1]

[1] Institute of Systematics and Evolution of Animals of the Polish Academy of Sciences, Kraków, Poland;

[2] Archaeological Research Collection, Tallinn University, Tallinn, Estonia;

[3] Department of Zoology, Institute of Ecology and Earth Sciences, University of Tartu, Tartu, Estonia;

[4] Institute of Geology, University of Innsbruck, Innsbruck, Austria;

[*] religa@isez.pan.krakow.pl – presenting author

Keywords: Late Bronze Age, zooarchaeology, taphonomy, isotopic analysis, death season analysis.

The Ridala site is located in the south-east of Saaremaa Island in Estonia. It is considered to be a defensive, single-phase settlement dating to the Late Bronze Age. Archaeological excavations carried out in the 1960s yielded a variety of zoological osteological material. Zooarchaeological and taphonomic analyses have provided insights into the dietary habits of the inhabitants of the settlement. Based on these results, we can conclude that the inhabitants of Ridala had different husbandry practices to those of inland Baltic area settlements at a similar time. The definitive predominance of goat and sheep remains over those of other farmed animals, such as cattle and pigs, distinguishes this site from others. The presence of large quantities of seal remains is less surprising given the location of the settlement near the sea, as seals would have provided an alternative food source. However, despite their easy access to marine resources, the inhabitants of Ridala did not fish for sea fish. Instead, remains of freshwater fish were collected at the site. In addition to mammals and fish, a small number of bird remains were also found, mainly representing a variety of waterfowl species.

Death season, strontium (Sr) and oxygen (O) isotope analyses carried out on individual domesticated species indicate a sustainable economy adapted to local conditions. The most of studied individuals showed $^{87}Sr/^{86}Sr$ matching local strontium isotopic composition, however, mammals moved to a different pastures during the summer and winter. The oxygen isotope data extracted from the dental enamel reflects the seasonal changes in the $\delta^{18}O$ values of drinking water. Therefore, the animals most likely had access to small bodies of water, such as streams. Additionally, the analysis of the season of death suggests culling at the end of the summer, probably to prepare supplies for winter.

The adaptation of the human inhabitants to the local conditions, as well as their consumption practices, render this site particularly significant for the study of Bronze Age settlements in the Baltic region.

[Talk] [student]

3D-ysalotosaurus: revealing the life history of an early-diverging iguanodontian dinosaur (Ornithopoda)

Riccardo Rocchi[1,*], Filippo Maria Rotatori[2,3], Gabriel S. Ferreira[4,5] & Federico Fanti[1,6]

[1] Dipartimento di Scienze Biologiche, Geologiche e Ambientali, University of Bologna, Bologna, Italy;
[2] GEOBIOTEC, Department of Earth Sciences, NOVA School of Science and Technology, Universidade NOVA de Lisboa, Caparica, Portugal;
[3] Museu da Lourinhã, Lourinhã, Portugal;
[4] Eberhard Karls University of Tübingen, Tübingen, Baden-Württemberg, Germany;
[5] Senckenberg Centre for Human Evolution and Palaeoenvironment at the University of Tübingen, Tübingen, Baden-Württemberg, Germany;
[6] Collezione di Geologia "Museo Giovanni Capellini", Università di Bologna, Bologna, Italy;
[*] riccardo.rocchi4@studio.unibo.it / riccardo.rocchi.2001@gmail.com – presenting author

Keywords: Ornithopoda, Iguanodontia, Late Jurassic, Tendaguru Beds Formation, ontogeny.

Dysalotosaurus lettowvorbecki is a small-sized, early diverging iguanodontian ornithopod known from multiple isolated remains collected from the Upper Jurassic Tendaguru Beds Formation in Tanzania. The discovery in the collection of the University of Tübingen of a young individual of *Dysalotosaurus lettowvorbecki* encased inside a mudstone block has offered an opportunity to study the associated material of this species and to shed new light on previously undocumented anatomical details. A micro-CT scanning of the block was performed at the 3D Imaging Lab of the University of Tübingen, and the resulting data were segmented to produce about 40 digital models of preserved elements of the appendicular and axial skeleton. The latter is represented by various cranial elements (including part of the braincase), the complete cervical series (except for the atlas and the axis), and four dorsal vertebrae. Part of the skull, cervical vertebrae III–IX, and the first two dorsal vertebrae were found in semi-articulation, in an opisthotonic position. Identifiable cranial elements are not fused together, showing a

condition indicative of osteological immaturity. Notably, the cervical vertebrae show mostly closed neurocentral sutures, whereas in the two more posterior dorsal vertebrae such structures are unfused and the neural arches are disarticulated from the centra. As we interpret this specimen representing an early ontogenetic stage of *Dysalotosaurus lettowvorbecki*, we hypothesize the presence of a previously unreported neurocentral fusion locus at the level of the cervical vertebrae. This would challenge the 'tail-to-head' fusion pattern invoked for many ornithopod dinosaurs. These findings also support the previously proposed interpretation that many anatomical traits in *Dysalotosaurus lettowvorbecki* show a high degree of precociality.

[Poster] [student]

The unique fossilization pattern in a Middle Triassic mixosaurid (Ichthyosauria)

Maciej Ruciński[1,*], Petter Nordenhaug[1], Lena Libe Delsett[1] & Mathieu Gabriel Faure-Brac[1]

[1] Natural History Museum, University of Oslo, Oslo, Norway;

[*] maciej.rucinski@nhm.uio.no – presenting author

Keywords: taphohistology, mineral replacement, diagenesis, histology, ichthyosaur.

Vertebrate bone is primarily composed of bioapatite, which typically undergoes early diagenesis that preserves its original microstructure through transformation into hydroxyapatite. In most cases in the fossil record, this phase involves some degree of ion or trace element substitutions within the apatite lattice, while preserving the original histological architecture. More rarely, complete mineral replacement by e.g., barite, pyrite, or calcite occurs, sometimes obliterating fine structural details. Here, we report a unique fossilization pattern in a Middle Triassic mixosaurid ichthyosaur from Svalbard, where the bone microstructure has undergone extensive alteration. Taphohistological and geochemical analyses reveal near-total loss of primary and secondary osteons and collagen fibres, with selective preservation limited to thin apatite fringes outlining cortical and trabecular frameworks, and isolated osteocyte lacunae. The remaining voids left after dissolved bone are infilled by syntaxial calcite overgrowth, a cement type common in invertebrate fossils but previously undocumented within vertebrate bone tissues. Additionally, the presence of localised barite pseudomorphing, pyrite and selective preservation of lacunae and apatite fringes suggests a complex, multiphase diagenetic sequence. The analysed specimen is encased in a phosphatic concretion composed of millimetre-scale calcium phosphate ooids chemically indistinguishable from the preserved bones. We preliminarily propose that phosphate diffusion from the degrading bone into the surrounding matrix facilitated concretion formation and subsequent calcitic replacement inside the bone tissues. However, the precise geochemical mechanisms underlying this transformation remain unresolved, requiring further studies. The implementation of such analyses has the potential to uncover complex diagenetic histories of fossils and to elucidate the interplay between taphonomic processes and bone microstructure, thereby refining the interpretation of histological data.

[Talk] [student]

The osteology and taxonomic status of the first described tanystropheid – *Tanystropheus conspicuus* von Meyer, 1852 (Reptilia, Archosauromorpha)

Adam Rytel[1,*]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[*] adam.rytel@twarda.pan.pl – presenting author

Keywords: Germanic Basin, Ladinian, Middle Triassic, Tanysauria, Keuper.

The long-necked tanysaurian (Archosauromorpha, Tanysauria) *Tanystropheus* continues to be one of the most peculiar Triassic reptiles. Despite long history of research and a relatively good fossil record, the biology of *Tanystropheus* still remains a subject of debate. This is largely due to its unique bauplan, but also the preservation of the available specimens, which constrain the analytical methods that could be applied. Only the type species of *Tanystropheus*, i.e., *Tanystropheus conspicuus*, is known from predominantly three-dimensional remains. The material previously referred to this taxon was, however, highly fragmentary and scarce. This situation changed recently with the discovery of numerous remains of *Tanystropheus conspicuus* in the Miedary locality (southern Poland), which yielded hundreds of fully three-dimensionally preserved remains. The aim of this study is to analyse the currently accessible material of *Tanystropheus* spp., carry out an extensive osteological redescription of *Tanystropheus conspicuus*, compare its anatomy with related forms, re-establish its taxonomic status, interpret its functional morphology, and finally, infer the lifestyle and habitat of *Tanystropheus*.

An extensive collection survey has revealed around 1000 isolated bones and teeth referrable to *Tanystropheus conspicuus*. Roughly one third of these specimens originated from localities in Germany, Poland, and France, while the rest has been recently excavated in Miedary. Element diversity is also the highest in Miedary, with this site yielding both isolated and articulated remains of over 20 individuals, which together provide an overview on a virtually complete skeleton (excluding most of the autopodial elements). The novel material includes the first cranial elements of *Tanystropheus* spp. not originating from Monte San Giorgio

(Switzerland/Italy). Moreover, the morphology of the vertebrae and ribs of the cervicodorsal transition of *Tanystropheus* is available in detail for the first time.

The main features distinguishing *Tanystropheus conspicuus* from other *Tanystropheus* species include: neural spines of most of the vertebrae being distally expanded, rugose and bulbous in appearance; the presence of a broad, extremely thin scapula with a considerably caudally expanded posterior portion; larger size, with some individuals reaching over six meters in total body length. The cranial elements from Miedary are similar in shape to those described for *Tanystropheus hydroides*, but differ in their proportions. These characteristics confirm the validity of *Tanystropheus conspicuus* and its non-conspecificity with *Tanystropheus hydroides*. Based on the re-evaluation of its skeletal and dental morphology, *Tanystropheus* is confirmed to be a (sub)aquatic dweller of shallow, near-shore environments.

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[Talk] [non-student]

A polypterid fish from the Miocene of Peru

Jorge D. Carrillo-Briceño[1], Tomáš Suchánek[2], Rodolfo Salas Gismondi[3], Donald Stewart[4], Robert Cerny[2], Torsten M. Scheyer[1], John J. Flynn[5], Pierre-Olivier Antoine[6] & **Marcelo R. Sánchez-Villagra**[1,*]

[1] University of Zurich, Department of Paleontology, Zurich, Switzerland;
[2] Department of Zoology, Faculty of Science, Charles University in Prague, Prague, Czech Republic;
[3] Laboratorio de Paleontología y Evolución de Vertebrados, Facultad de Ciencias y Filosofía/CIDIS, Universidad Peruana Cayetano Heredia, Lima, Perú;
[4] Department of Environmental Biology, SUNY College of Environmental Science and Forestry, Syracuse, New York, USA;
[5] Division of Paleontology, American Museum of Natural History, New York, New York, USA;
[6] Institut des Sciences de l' Évolution de Montpellier, University of Montpellier, CNRS, IRD, EPHE, Montpellier, France;
[*] m.sanchez@pim.uzh.ch – presenting author

Keywords: Polypteridae, Bichirs, Neogene, Gondwana, South America, extinction.

Polypterids are bony fishes hypothesized as the sister group of ray-finned fishes and of Gondwanan origin. Extant polypterids are represented only by *Erpetoichthys* (1 species) and *Polypterus* (14 species) and are distributed exclusively in Africa. Ten extinct polypterid genera, eight from Africa, have been described based on isolated bony elements from the Late Cretaceous–Paleocene strata; those are mainly pinnules (dorsal spines) and scales. One species was described based on a partially complete skeleton and another on an ectopterygoid bone. Of the ten extinct genera, the only records outside Africa are the genera *Dagetella* and *Latinopollia* from the Maastrichtian–Paleocene of South America (in Bolivia and southwestern Brazil, respectively). Here, we present polypterid remains from the Peruvian Amazon, collected in Miocene strata of the Pebas Formation. Cranial elements are described, and histological

analyses and 3D model segmentation have been performed to observe composition and micro- and macrostructure of the dermal bones, including analysis of cranial lateral line canals. The new fossils, including remains of ganoid scales, differ from extant polypterids and from what we know of other fossil specimens. However, the non-overlap of anatomical elements known from previously described polypterid fossil taxa prevents us for now from naming of a new taxon based on these Peruvian specimens. These fossils represent the youngest known record of polypterids outside of Africa, suggesting a ghost lineage of at least 40 million years in South America for this clade. Like lungfishes and some osteoglossiform fish clades, polypterids have had a long history but with little diversity across the Cenozoic of South America. Our study is part of a larger examination of the Neotropical Neogene fish fossil record supported by Swiss National Science Foundation Grant 320030-231714, with field and collection support from the institutions of the authors. Our studies of fossils from sites near Iquitos, Peru; La Venta deposits in Colombia; and Urumaco Formation in Venezuela provide insights on extinctions and local extirpations of Neotropical fishes correlated with rise of the Andes and dynamics of the Pebas Lake system.

[Talk] [non-student]

Sauropodomorph (Dinosauria) cranial topology: a comparative anatomical network analysis

Tim Schuurman[1,*], Emiliano Bruner[1] & Fabien Knoll[1]

[1] Museo Nacional de Ciencias Naturales, CSIC, Madrid, Spain;

[*] timschrmn@gmail.com – presenting author

Keywords: Network theory, functional craniology, spatial constraints, integration, modularity.

Cranial morphology is influenced intrinsically by constraints due to the spatial arrangement of its anatomical components: the cranial bones. Network theory can be applied in this context to perform comparative analyses regarding the spatial arrangement of the cranium in different sauropodomorph dinosaur species, according to the criterium of physical interaction: the joints, sutures and synchondroses. This methodology is known as anatomical network analysis.

In this study, anatomical network models of the crania of 15 sauropodomorph species are presented and compared. The goal was to examine which bones are fundamental in the topological balance of the sauropodomorph crania, to find underlying phenotypic patterns of spatial organization, and to understand how these patterns might have channelled the evolution of cranial morphology in this clade.

We generated networks based on the whole cranium of 15 sauropodomorph species. The nodes and edges of the networks formalize the crania's bones and joints, respectively. The final networks comprise 41.5 ± 3.5 nodes and 105.5 ± 10.5 edges. Anatomical network analysis supplies morphological information locally, referring to the relevance and roles of specific bones, and globally, quantifying the crania's overall complexity and organization.

Our results indicate that, locally, the frontal (or frontals, if the bone is paired), laterosphenoids (whether fused or unfused with the orbitosphenoids), parabasisphenoid, and parietal (or parietals, if the bone is paired) are embedded in a severely complex topological context. These elements are subjected to strong spatial constraints, suggesting that their respective cranial regions are highly influential in shaping the morphological evolution of the system. Globally, the cranial networks show a clear topological compartmentalization of their regions. For

instance, most species display a longitudinal separation between the bones of the facial skeleton and those of the neurocranium. This compartmentalization, or modularity, is noteworthy as it highlights groups of bones that undergo morphological evolution in an integrated fashion.
These results should be considered properly in ontogenetic and phylogenetic studies of morphological diversity in the crania of sauropodomorph dinosaurs.

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[Poster] [non-student]

A new look at the dinosaur diversity of the Tendaguru Formation in Tanzania

Daniela Schwarz[1,*], Verónica Díez Díaz[1], Amy Campbell[1], Wilson Jilala Viscent[2] & Pastory M. Bushozi[3]

[1] Museum für Naturkunde, Leibniz Insitute for Evolutionary and Biodiversity Research, Berlin, Germany;
[2] National Museum of Tanzania, Dar es Salaam City, Tanzania;
[3] University of Dar es Salaam, College of Humanities, Department of Archaeology and Heritage Studies, Dar es Salaam City, Tanzania;
[*] Daniela.schwarz@mfn.berlin – presenting author

Keywords: Tendaguru, Tanzania, Jurassic, dinosaur, diversity.

The Tendaguru Formation in Tanzania was exploited during the colonial German Tendaguru Expedition (GTE, 1909-1913) and is famous for its diverse Late Jurassic dinosaur fauna. The formation consists of three fossiliferous strata which are separated from each other by marine and transitional successions and cover a time of Late Oxfordian to Late Tithonian. The Middle (MDM, Kimmeridgian), and Upper (UDM, Tithonian) Dinosaur Members have yielded the majority of dinosaur bones, including a taxonomically rich fauna of sauropod dinosaurs. However, when compared with each other, there is a notable change in taxonomic (four vs. seven) and phylogenetic (only neosauropods vs. a large eusauropod spectrum) record of sauropod diversity in the MDM and UDM. Ornithischian dinosaurs are known mostly only from the MDM. Theropod dinosaurs seem to be equally represented in both MDM and UDM, but due to the predominance of isolated tooth finds this representation should be interpreted with caution.

An ongoing analysis of the old field catalogues of Werner Janensch (GTE leader between 1909 and 1911), shows discrepancies between the field catalogues and the current collection catalogue of the Museum für Naturkunde in Berlin (MfN), revealing potential biases in the preserved record. For example, quarries “dd” (MDM) and “K” (UDM) exhibit significant discrepancies between documented and preserved specimens, highlighting loss of material

between excavation and the collection accession. It is thought that this particularly affects the determination of diplodocid material and the record of the taxonomic variety of this group.
At this stage, the interpretation of the dinosaur diversity in these two strata can only be preliminary because the number of single quarries differs from ca. 21 in the MDM to over 40 in the UDM. In addition, the finds of more complete skeletons and the presence of a bonebed locality (Ig/WJ) in the MDM add up to a larger number of bone finds of a particular taxon. However, the faunal shifts between the MDM and UDM are apparent and comparisons with contemporary faunas like the North American Morrison Formation and the Lourinhã Formation of Western Portugal need to take them into account. The observed diversity changes in the Tendaguru Formation, particularly within herbivorous dinosaurs, likely reflect environmental fluctuations, such as changes in the availability of fodder plants. Additionally, these changes may indicate shifts in dinosaur migration patterns, facilitating the introduction of new faunal elements into the Tendaguru region during the Tithonian.

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[Talk] [non-student]

The first avian tracks from Armenia's Mio-Pliocene transition

Lara Sciscio[1,2,*], Sergei Lazarev[1,2], Lilit Sahakyan[3] & Davit Vasilyan[1,2]

[1] JURASSICA Museum, Porrentruy, Switzerland;

[2] Department of Geosciences, University of Fribourg, Fribourg, Switzerland;

[3] Institute of Geological Sciences of the National Academy of Science of the Republic of Armenia, Yerevan, Armenia;

[*] lara.sciscio@jurassica.ch – presenting author

Keywords: Avian ichnology, *Charadriipeda*, Late Miocene–Early Pliocene, Voghjaberd Formation, Armenia, palaeoecology.

During fieldwork near Voghjaberd village, Armenia, Dr Araik Grigoryan and colleagues from the Institute of Geological Sciences (Yerevan, Armenia) discovered avian tracks on several ex-situ volcaniclastic blocks from the Neogene Voghjaberd Formation. Preserved as natural impressions, the small tracks (pes length < 5 cm) represent the first ichnological evidence of birds in the region. We describe at least two distinct morphotypes from the Voghjaberd site: (1) small tridactyl tracks (mean length 2.7 cm, width 4 cm) with a wide II^IV divarication (123° on average), resembling *Charadriipeda* and attributed to water margin/shorebirds; and (2) tetradactyl, webbed tracks (*Presbyorniformipes*-like), indicating waterfowl. The presence of possible associated probe marks suggests foraging behaviour, and collectively, the assemblage represents a "shorebird" ichnofacies. Based on the volcaniclastic depositional context of the Voghjaberd Formation, and the morphology of the tracks themselves, the tracks likely reflect avian activity in a wetland environment of this volcanically active region. This study also presents the first radiometric date for this site (5.28 ± 0.11 Ma), establishing a chronological framework for the latest Miocene to earliest Pliocene avian tracks and enabling comparisons with other Armenian localities (e.g., Jradzor, Nurnus) and similarly aged sites worldwide. While avian body fossils have been recovered from other Armenian localities (e.g., the Pliocene Jradzor site), they remain unstudied in this context. Despite a limited number of tracks currently recovered and their taphonomic limitations, the Voghjaberd tracks enrich the avian fossil record of the South Caucasus and highlight Armenia's potential for further Neogene ichnological discoveries.

[Talk] [non-student]

Ecological niche partitioning in European titanosaurs (Dinosauria, Sauropoda): data from the lower jaw morphology

Albert Sellés[1,2,*], Bernat Vila[1,2], Verónica Díez Díaz[2] & Jean Le Loeuff [4]

[1] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain;

[2] Museu de la Conca Dellà, Lleida, Spain;

[3] Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany;

[4] Musée des Dinosaures, Espéraza, France;

[*] albert.selles@icp.cat – presenting author

Keywords: Titanosauria, niche, ecology, dentary, feeding behaviour.

The lower jaw morphology of vertebrates plays a crucial role in ecological specialization, as it directly influences feeding mechanics and dietary adaptations. These specializations are particularly significant in diverse ecosystems, facilitating niche partitioning among coexisting taxa. Among sauropod dinosaurs, this phenomenon is exemplified in the Late Jurassic-Early Cretaceous faunas of North America, Africa, and Europe. Despite the fact that titanosaurian sauropods account for nearly 30 % of known sauropod diversity, their craniomandibular fossil record remains highly fragmentary, hindering comprehensive morphological analyses of the relationship between dentary shape and dietary specialization among coexisting species. Newly discovered and previously known dentary material from the latest Cretaceous of southwestern Europe (Spain and France) provide the first opportunity to assess potential ecological niche partitioning among European titanosaurs based on lower jaw morphology. We examined four specimens from three distinct localities: two dentaries of indeterminate titanosaurians from the early late Maastrichtian Els Nerets and Molí del Piteu sites (Tremp Basin, Catalonia, Spain) and two specimens from the late Campanian Bellevue locality (Espéraza, southern France), identified as *Ampelosaurus* and the "Eva" specimen. To characterize the dentary morphology, we employed the Arcade and Dentary indexes, and the Dentary Divergent Angle, which are

modifications of previously established metrics (Premaxilla-Maxilla Index and Premaxilla Divergent Angle). To place the studied specimens within a broader ecomorphological framework, we additionally incorporated data from dentaries of 13 titanosaurian, five diplodocoidean, and three non-titanosaurian macronarian taxa from worldwide localities. Both bivariant and multivariant analyses (PCA) revealed a distinct morphospace differentiation among European titanosaurs. The dentary of the Els Nerets specimen and *Ampelosaurus* are placed close to the narrow and straight lower jaws of *Malawisaurus*. The dentary of "Eva" occupies an intermediate morphospace, positioned between the rounded jaws of *Rapetosaurus* and *Nemegtosaurus* and the narrower jaw of *Sarmientosaurus*. Notably, the dentary of the Molí del Piteu titanosaur represents a novel morphology previously unreported in Sauropoda, filling a significant gap in their morphological record. The broad and rounded dentary from Molí del Piteu, is indicative of non-selective, ground-height browsing, while the narrower, rounded jaw of "Eva" suggests a selective mid-height browsing strategy. In contrast, the narrow, straight jaws of the Els Nerets titanosaur and *Ampelosaurus* likely correspond to a selective canopy browsing strategy. These findings support the hypothesis of complex feeding niche partitioning among European titanosaurs, underscoring the role of lower jaw morphology in ecological differentiation.

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[Poster] [non-student]

Deep-Learning in Palaeontology: a Convolutional Neural Network approach to dinosaur eggshell identification

Salvador Giró[1,2], Angel Galobart[1,3] & **Albert Sellés**[1,3,*]

[1] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain;

[2] Facultat de Ciències de la Terra, Universitat de Barcelona, cMartí i Franquès, Barcelona, Spain;

[3] Museu de la Conca Dellà, Isona, Lleida, Spain;

[*] albert.selles@icp.cat – presenting author

Keywords: Artificial Intelligence (AI), machine learning, Convolutional Neural Network (CNN), image processing, classification.

Artificial intelligence (AI) and machine learning (ML) are playing an increasingly prominent role in both scientific research and broader societal contexts. In the domain of image processing, these technologies have been predominantly employed for classification tasks. While AI methodologies have seen widespread adoption across numerous scientific disciplines - including medicine, astronomy, genomics, and environmental science - their integration into palaeontology remains limited, where traditional manual techniques continue to prevail. Despite significant advancements in fossil image processing and analysis - early attempts focusing on segmentation and classification tasks - these procedures often require considerable user involvement, rendering them time-consuming and susceptible to subjectivity and human error. The present study aims to assess the efficacy of convolutional neural networks (CNNs) - a type of deep learning algorithm specifically designed for computer vision applications—in the classification of dinosaur eggshell types. Although certain quantifiable features are present in eggshell microstructure, classification of this fossil type often relies on qualitative attributes that are challenging to define or measure objectively. For this purpose, pre-trained CNN models were implemented using the MVTEC Halcon software environment. The dataset comprises over 1,000 micrographic images of dinosaur eggshells, encompassing four oogenera

(*Megaloolithus*, *Cairanoolithus*, *Spheroolithus*, and *Fusioolithus*) from the uppermost Cretaceous strata of the Southern Pyrenean basins (Catalonia, Northeastern Spain). The results demonstrate that CNNs achieve high classification accuracy at low parataxonomic levels (oogenera), proving that this methodology is particularly advantageous in instances where traditional quantitative approaches are inadequate for accurate classification. Furthermore, AI enables scalable data analysis, improved pattern recognition, and enhanced reproducibility - critical benefits when working with large datasets or subtle morphological variations. Overall, the findings underscore the robustness and effectiveness of CNN-based classification for distinguishing among genus-level dinosaur eggshells. Moreover, this study highlights the potential of deep learning technologies as valuable tools in palaeontological research, facilitating accurate and reproducible analyses by users who may not possess specialised expertise in computational image analysis.

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[Poster] [non-student]

A review of the Cenozoic fossil record of avian eggs, eggshells, and nests

Xavier Panadès i Blas[1,2], Àngel Galobart[1,2] & **Albert Sellés**[1,2,*]

[1] Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain;
[2] Museu de la Conca Dellà, Lleida, Spain;
[*] albert.selles@icp.cat – presenting author

Keywords: Aves, reproduction, eggshells, environmental changes.

The Cenozoic fossil record of avian eggshells, nests, and eggs provides an invaluable perspective on the evolutionary, ecological, and reproductive history of birds over millions of years. Spanning from the Paleocene to the Holocene, this record reveals critical transitions in avian biodiversity and highlights adaptive strategies to diverse and changing environments. Fossilised eggshells of large flightless birds such as *Gastornis*, *Lithornis*, and *Struthio* demonstrate innovations in nesting behavior and structural adaptations that enabled survival in challenging climates. Paleocene fossils mark the resurgence of avian lineages following the K-Pg extinction, while Eocene records show significant diversification, including globally distributed taxa like Presbyornithidae and emerging palaeognaths. The Miocene documents the emergence of specialised ratites, such as ostriches (*Struthio*) and Dromornithidae, adapted to open grasslands and arid conditions in parallel with global climatic shifts. Fossils from Iberia, New Zealand, and Australia underscore ecological pressures as key drivers of avian reproductive strategies and geographical distributions. The Pliocene epoch reflects diversification in ground-nesting birds, while Pleistocene records illustrate resilience among species such as elephant birds, moa, and flamingos, alongside evidence of human interactions, including cultural uses of ostrich eggshells and anthropogenic impacts on extinctions. Holocene records trace adaptive responses of ratites, penguins, flamingos, and waterfowl to human-induced environmental changes. Advances in palaeogenetics, palaeomolecular studies, and isotope analysis elucidate avian genetics, diets, and palaeoenvironments, resolving debates on

species attributions and emphasising the interplay of climate and human activity. This dynamic avian fossil record offers a foundational framework for understanding past ecosystems and conserving biodiversity for the future.

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[Talk] [non-student]

An enigmatic longirostrine fish (Teleostei, Tselfatiiformes) from the Upper Cretaceous of Northern Italy pushes the boundaries of evolutionary convergence in Teleostei

Giovanni Serafini[1,2,*], Jürgen Kriwet[3], Tommaso Toldo[1], Eliana Fornaciari[4], Jacopo Amalfitano[4] & Giorgio Carnevale[5]

[1] Dipartimento di Scienze Chimiche e Geologiche, Università degli Studi di Modena e Reggio Emilia, Modena, Italy;
[2] Museo di Paleontologia e Preistoria "Piero Leonardi", Sistema Museale di Ateneo, Università degli Studi di Ferrara, Italy;
[3] Department of Palaeontology, Faculty of Earth Sciences, Geography and Astronomy, University of Vienna, Vienna, Austria;
[4] Dipartimento di Geoscienze, Università degli Studi di Padova, Padova, Italy;
[5] Dipartimento di Scienze della Terra, Università degli Studi di Torino, Turin, Italy;
[*] giovanni.serafini@unimore.it – presenting author

Keywords: Tselfatiiformes, billfish morphology, microdentition, oil glands, pelagic ecology.

The Ligurian Complex of the Northern Apennines (Northern Italy) comprises chaotic outcrops of deep-sea sediments from the Lower–Upper Cretaceous. The complex is representative of an abyssal plain palaeonvironment and has yielded a fragmentary but significative record of pelagic vertebrate megafauna. In 2023, a large fossilized rostrum fragment was reevaluated from the palaeontological collections of the University of Modena and Reggio Emilia. The specimen, collected from the Northern Apennines of Modena province, was previously attributed to an Eocene billfish due to the presence of cylindrical bones and small teeth. Thanks to nannoplankton analysis of the matrix, the specimen was reassigned to the Upper Cretaceous. Rostral osteology, coupled with the improved stratigraphic provenance, lead to the identification of the specimen as a longirostrine plethodid tselfatiiform (Actinopterygii, Teleostei) rather than a billfish. The specimen is unique among plethodids, with a deep,

cylindrical snout and a total body length estimate exceeding 2.5 meters. The rostrum exhibits a remarkable degree of morphological convergence with extant xiphioid billfishes, together with completely unique features, such as a deep longitudinal fossa at the mesethmoid-premaxilla suture not dissimilar to that of parvipelvian ichthyosaurs. Tiny conical teeth capped by a translucent acrodin tip are found between jaw rami. Comparative analysis with the modern swordfish (*Xiphias gladius*) dentition provided insights on shared similarities between the two types of reduced dentition. Computed tomography scanning of the specimen revealed a large, subtriangular and tripartite vacuity in the upper jaw. A similar structure is represented by the rostral sinus of modern billfishes, which is known to host oil-producing glands to reduce drag on the skin. The cumulative features gathered from the specimen suggest a fast, pelagic predatory ecology of the animal. The findings further confirm the homoplastic development of a billfish-like body plan in Tselfatiiformes, with independently acquired physio-morphological adaptations that preceded the evolution of xiphioids.

[Poster] [non student]

Intraspecific bite marks on tooth roots of thalassophonean pliosaurids (Plesiosauria): pathological malocclusion or inflicted trauma?

Giovanni Serafini[1,2,*], Eudald Mujal[3,4]; Daniel Madzia[5] & Ursula Thun Hohenstein[2,6]

[1] Dipartimento di Scienze Chimiche e Geologiche, Università di Modena e Reggio Emilia, Modena, Italy;

[2] Museo di Paleontologia e Preistoria "Piero Leonardi", Sistema Museale di Ateneo, Università degli Studi di Ferrara, Ferrara, Italy;

[3] Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany;

[4] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Catalonia, Spain;

[5] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[6] Dipartimento di Studi Umanistici, Università degli Studi di Ferrara, Ferrara, Italy;

[*] giovanni.serafini@unimore.it – presenting author

Keywords: Pliosauridae, dental marks, oral paleopathology, inflicted traumas.

Preliminary observations of dental marks on thalassophonean pliosaurid teeth are presented. Two large (260 mm and 150 mm long respectively) marine reptile teeth were analyzed from the palaeontological collection of the Museo di Paleontologia e Preistoria Pietro Leonardi (Ferrara University, Italy). The specimens originate from the Middle Jurassic of the United Kingdom, most likely from the Callovian of the Jurassic Coast. However, more precise information regarding their exact provenance is currently unavailable and requires further investigation. Both teeth originate from an indeterminate large-bodied thalassophonean pliosaurid, with crown morphology and ornamentation closely resembling those of *Liopleurodon* and *Simolestes*. The tooth roots are gashed by tooth marks that are directed from cervix dentis to the root apex, with clear imprints of an apicobasally-ridged crown on the orthodentine and cementum of the root. Each tooth bears a single tooth mark, one on the labial side and the other one on the lingual side. The tooth marks show the same ornamentation as the host crowns. Two possible explanations for the presence of the same-taxon dental marks on the roots are

discussed: 1) the marks are pathologically self-inflicted in nature and represent dental malocclusion; 2) the marks are caused by another individual and are therefore representative of a trauma inflicted through intraspecific interaction. Malocclusions have been commonly reported in Pliosauridae, with evidence of pronounced spalled surfaces and/or cavities in the dental and mandibular tissue. The fine detail of the crown ornamentation imprint is, however, seemingly indicative of a single interaction rather than repeated behavior, possibly advocating for the inflicted trauma hypothesis. Same-taxon face bites are common in marine tetrapods, often linked to intraspecific competition, aggressive courtship, or mating.

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[Talk] [student]

New end-Devonian early tetrapod material from Greenland

Rebecca Sheng[1,*], Dana Korneisel[1], Grzegorz Niedzwiedzki[1] & Per Erik Ahlberg[1]

[1] Department of Organismal Biology, Uppsala University, Uppsala, Sweden;
[*] rebecca.sheng@ebc.uu.se – presenting author

Keywords: early Tetrapoda, Devonian, Greenland.

The tetrapod stem group appeared during the Devonian, and the earliest known crown tetrapods come from the early Carboniferous. The Hangenberg event, a mass extinction at the Devonian–Carboniferous boundary, affected the diversity of many jawed vertebrate clades. However, its impact on tetrapods is not well understood, largely due to the period of patchy tetrapod fossil record from the end-Devonian into the early Carboniferous known as Romer's Gap. New tetrapod specimens from a bone bed of latest Famennian age from the Stensiö Bjerg Formation of Celsius Bjerg, East Greenland – the youngest known multi-species assemblage of Devonian tetrapod fossils – occupies the beginning of Romer's Gap and illuminates the tetrapod biota that encountered the Hangenberg crisis. This death assemblage samples multiple aspects of a complex terrestrial ecosystem, with the preservation of coprolites and a variety of ichnofossils in addition to body fossils of tetrapods, arthropods and plants – but thus far no skeletal remains or coprolites of fish.

The specimens were imaged using propagation phase-contrast synchrotron microtomography (PPC-SRμCT) performed at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France, and then virtually segmented and rendered. Specimens segmented so far represent at least five new species, none of which can be assigned to any of the known Devonian early tetrapods from Greenland (*Ichthyostega*, *Acanthostega*, *Ymeria*, and *Brittagnathus*). The humeri alone comprise of at least four different morphotypes. Curiously, compared to all known early tetrapod humeri, three of the morphotypes most closely resemble ANSP21350, an isolated humerus from the Catskill Formation, USA, which is regarded as having a root-ward morphology among stem tetrapods. The 4th humeral morphology comes from a much smaller

individual, and it has an unfinished anterior margin resembling that of Carboniferous tetrapods such as *Crassigyrinus*. Most strikingly, a partly articulated skeleton has revealed a distinctly unexpected pelvic architecture which is robust and weight-supporting. The new Stensiö Bjerg Formation tetrapod assemblage highlights the incompleteness of our current picture of Devonian early tetrapods. It is clear that a new and important faunal assemblage is emerging.

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[Talk] [non-student]

Allometric growth in Tyrannosauridae (Dinosauria, Theropoda)

Justyna Słowiak[1,*] & Tomasz Szczygielski[1]

[1] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[*] justyna.slowiak@twarda.pan.pl – presenting author

Keywords: Dinosaurs, Tyrannosauridae, allometry, ontogeny.

Tyrannosauridae represents one of the largest groups of carnivorous dinosaurs, characterized by massive heads and shortened two-fingered forelimbs. Within the tyrannosaurids, three groups are distinguished: the medium-sized, gracile Alioramini, the large but lightly build Albertosaurinae, and the large and bulky Tyrannosaurinae. Herein, we performed a bivariate analysis showing the proportional changes in the skull and postcranial skeleton of 66 tyrannosaurids sorted into three groups: alioramins (*Alioramus* spp., *Qianzhousaurus sinensis*), albertosaurines (*Gorgosaurus libratus*, *Albertosaurus sarcophagus*), and tyrannosaurines (*Tyrannosaurus rex*, *Tarbosaurus bataar*, *Daspletosaurus* spp.). The length of the femur scales isometrically to the skull and mandible length, the alioramins having longer skulls than other tyrannosaurids of comparable size. In all groups, the maxillary tooth row length and the snout length indicate similar growth rates than the femoral or skull length (isometry). The snout height, when compared to the maxillary tooth row and skull length, decreases during growth in alioramins, is isometrical in tyrannosaurids, and increases during growth in albertosaurines. The orbit height indicates an isometrical growth ratio with the skull and mandible length, and the tyrannosaurines have proportionally longer orbital fenestrae than the albertosaurines or alioramins of similar skull / mandible sizes. The dentary tooth row increases in size isometrically when compared to the maxillary tooth row. All the hindlimb bones in the Tyrannosauridae scale in size with negative allometry to the femur length. Juvenile tyrannosaurids proposed to be putative representatives of *Tarbosaurus bataar* (holotypes of *Shanshanosaurus huoyanshanensis* and *Raptorex kriegsteini*) cluster together with the definite juvenile *Tarbosaurus bataar* MPC-D (Mongolian Palaeontological Center, Mongolian Academy of Sciences, Ulaanbaatar, Mongolia) 107/7. The putative juvenile of *Tyrannosaurus*

rex CMNH (Cleveland Museum of Natural History, Cleveland, USA) 7541 (holotype of *Nanotyrannus lancensis*) clusters within the tyrannosaurines, but another specimen, BMRP (Burpee Museum of Natural History, Rockford, USA) 2002.4.1 'Jane', is an outlier, exhibiting slenderer morphology than other tyrannosaurines. The diversified growth trajectories of tyrannosaurids suggest their varied ecomorphological adaptations. The observed clustering of juveniles may facilitate proper taxonomic recognition of immature specimens, the identification of which is notoriously problematic.

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[*Invited lecture*]

The taphonomy and biodiversity of the Eocene Messel Pit

Krister T. Smith[1,2,*]

[1] Department of Messel Research and Mammalogy, Senckenberg Research Institute, Frankfurt am Main, Germany;

[2] Institute of Ecology, Diversity, and Evolution, Goethe University Frankfurt, Frankfurt am Main, Germany;

[*] krister.smith@senckenberg.de – presenting author

Keywords: Messel, Eocene, greenhouse, taphonomy, biodiversity.

The *Konservat-Fossillagerstätte* known as the Messel Pit preserves a record of a terrestrial ecosystem from the last greenhouse phase of Earth's climate with exceptional fidelity, which led ultimately to its induction as a UNESCO World Heritage Site. Most, but not all, fossils have been described from the bituminous shale ("oil-shale") of the Middle Messel Formation, which was mined for around one century due to the high proportion of kerogen and other organic compounds. In view of the threefold anniversary celebrated this year at Messel – 150 years since the discovery of the first fossil (1875), 50 years of systematic excavations (1975), and 30 years since its recognition as a world heritage site (1995), an overview of the taphonomy and the biodiversity recovered so far is timely.

In total 1409 taxa have been recorded thus far at Messel, making it one of the richest fossil localities. These include 813 green plant taxa (amongst them 182 taxa of seeds and fruit, 349 taxa of foliage and shoots, and 259 taxa of pollen and spores), 7 fungal taxa, 397 invertebrate taxa (amongst them 279 body fossil and 118 trace fossil taxa) and 190 vertebrate taxa (amongst them 19 coprolite taxa). The biological species diversity represented by this assortment is lower but imprecisely known. Biodiversity-theoretic methods suggest that at most three-quarters of the true diversity of many groups has been sampled, and in many cases that proportion is

probably substantially lower. The species diversity of individual groups is higher than in Central Europe today, but lower than in tropical biotopes, consistent with the recognition of a "paratropical" climate at Messel.

While the question of the preservation of the fossils is reasonably well understood – the water column in the deep maar lake became stratified, and its lower reaches anoxic, leading to very slow rates of decay unaffected by scavenging or bioturbation – the origin of the fossils, especially the animal fossils, is less so. Thus far, two major hypotheses were discussed: (1) clouds of toxic gases that either asphyxiated organisms directly or caused them to drown following inhalation-induced unconsciousness, or (2) poisoning as a result of imbibing water suffused with cyanobacterial toxins. Yet, the null hypothesis of accidental death must first be falsified. Comparison of bat mortality – bats being one of the most common groups of tetrapods at Messel – between Messel and modern swimming pools did not demonstrate a markedly higher mortality at Messel, and mass mortality horizons are virtually unknown. Present evidence does not demonstrate that Messel was a "death trap."

[Talk] [non-student]

Inferences on the palaeobiology of the early archosauromorph *Prolacerta broomi*

Gabriela Sobral[1,*] & Martin D. Ezcurra[2]

[1] Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany;

[2] CONICET–Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Buenos Aires, Argentina;

[*] gabriela.sobral@smns-bw.de – presenting author

Keywords: Archosauromorpha, Triassic, palaeoneurology, palaeoecology, vision.

Archosauromorpha is a clade of diapsid reptiles comprising living crocodylians and birds, and all fossil groups more closely related to them than to lepidosaurs. The group originated in the latest Permian, and radiated to a broad array of environments before the origin of the crown, including aquatic and possibly gliding forms. Among terrestrial taxa, most were specialized for carnivory, but earlier members like *Prolacerta broomi* were probably faunivorous. As no diel activity pattern has been formally proposed for *Prolacerta broomi*, here we analyse the scleral ossicle ring anatomy for the first time based on a new specimen. The ring is composed of 20 ossicles, a number greater than that documented for extant reptiles, which varies from 10 to 18 – the highest numbers usually found in birds. This total is also higher than that of 13–14 ossicles reconstructed earlier for this taxon based on a specimen with an incomplete scleral ring. Each ossicle is formed proximally by an anteroposteriorly long plate and a projection extending distally, similar to squamates like *Lacerta viridis*. Dorsally on the ring, these projections are tall and narrow, but not ventrally, where they are short and broad, similar to the rhynchocephalian *Sphenodon punctatus*. The scleral ring is slightly elliptical, with the anteroposterior axis measuring 9.16 mm and the dorsoventral one 6.22 mm internally. Compared to the orbit, which is also slightly elliptical (19.11 mm long and 15.5 mm high), this gives a relatively small aperture, suggesting that *Prolacerta broomi* was photopic (diurnal) and corroborating its generalist habits. It is also interesting to notice that with an anteroposterior length of 19.22 mm

and height of 15.14 mm externally, the scleral ring is overall very large, occupying most of the orbital area. In fact, the plate projections extend beyond the orbital rim and underneath the orbital bones in some places. This results in a large surface for the attachment of eye muscles that help in corneal accommodation. This is found in taxa with demonstrably good vision, such as ichthyosaurs and birds, indicating that *Prolacerta broomi* also had an accurate viewing sense. Together with *Euparkeria capensis* and *Proterosuchus fergusi*, which were suggested to have scotopic and mesopic vision respectively, this is only the third time a diel activity pattern has been calculated for stem-archosaurs, corroborating the diverse palaeobiological roles occupied by the group.

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[Poster] [student]

The wolf is full, and the hyena is gone – the causes of the extinction of the cave hyena *Crocuta crocuta spelaea* (Goldfuss, 1823) in Europe

Maciej Struski[1,*]

[1] SKN of Palaeobiology, Department of Palaeozoology, University of Wrocław, Wrocław, Poland;

* 339326@uwr.edu.pl – presenting author

Keywords: Hyaenidae, extinction, Pleistocene, palaeoecology.

Hyenas have a unique biology, evolution, and a set of features and adaptations not seen in other groups. Hypercarnivory, gnawing on bones accumulated in dens, strongly hierarchical clans in which individuals give birth to small cubs, over which they provide long-term parental care. This life strategy guaranteed great success in an area with a large number of potential prey. However, the cave hyena disappeared from Europe around 21 Ka ago. It was also one of the most rapidly disappearing large carnivores in the Eurasian fauna of that period. Why? There are several leading theories.

Competition from other carnivores appears to have had a serious influence, mainly coming from the cave wolf *Canis lupus spelaeus* Goldfuss, 1823 and the cave lion *Panthera spelaea spelaea* (Goldfuss, 1810). Climate change was also a significant factor and resulted in the impoverishment of the food base, which severely affected hyenas owing to the fact that they were not very flexible in this aspect. The high specialization of dentition also imposed a specific type of food, i.e., frozen carcasses of large ungulates. When the food base decreased with the changes in the environment, the narrow ecological niche worked to the disadvantage of hyenas. Competition with humans certainly also played a significant role – after all, they were another user of the same, limited resources in the ecosystem. Moreover, they posed a serious threat.

All these factors outline a model example of extinction – the niche disappears due to changes in the environment, the species begins to cope worse and worse, is unable to adapt in time, disappears and dies out. Further studies of the fossil record ought to provide increasingly precise estimates of the moment when the last hyena disappeared from Europe and subsequent palaeoecological data will allow even more accurate indication of the key factors in the extinction process.

[Talk] [non-student]

Limb anatomy of the aetosaur *Stagonolepis olenkae* (Aetosauria, Stagonolepididae)

Dawid Dróżdż[1], Tomasz Szczygielski[2] & **Tomasz Sulej**[2,*]

[1] independent researcher, Warsaw, Poland;

[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[*] sulej@twarda.pan.pl – presenting author

Keywords: Anatomy, Late Triassic, Pseudosuchia, Aetosauria, scratch-digging.

Heavily armored aetosaurs (Pseudosuchia) are among the most iconic megafauna of the Late Triassic. However, only a few species are known from complete skeletons or articulated material. The material of *Stagonolepis* collected from the Polish Krasiejów locality is one of the most abundant when it comes to limb material, including long bones as well as articulated parts of the limbs.

They are heavily built, as in other aetosaurs of comparable sizes. The Krasiejów species *Stagonolepis olenkae* had pillar-erect gait similar to other advanced contemporary pseudosuchians of the Late Triassic, such as poposaurids and 'rauisuchian'- grade pseudosuchians, The proportions of the limbs in *Stagonolepis olenkae* as well as the strong development of muscle attachments suggest that it was able to perform strong movements in a parasagittal plane with either forelimbs and hind limbs. An increased strength of the limbs and erect gait probably helped to support the heavy dermal armor of the animal. In addition, we recognized features that can be associated with scratch-digging behavior, such as the presence of enlarged unguals of the first digit in both forelimbs and hind limbs. These characters can be observed also in other aetosaurs, but they are better developed in advanced aetosaurs.

It appears that aetosaur limbs and girdles share the general body plan typical for all pseudosuchians, but they are evolutionary modified to support the weight of the body and perform strong movements at the cost of mobility, in contrast to other contemporary pseudosuchians that show more cursorial adaptations.

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[Poster] [non-student]

Proteolytic fungal activity in remains of soft tissues preserved in over 200-million-years-old theropod bones

Dawid Surmik[1,*], Monika Malicka[2], Katarzyna Zaremba-Niedźwiedzka[3] , Paweł Dąbczyński[4], Alicja Staniek[1] & Grzegorz Niedźwiedzki[5]

[1] Institute of Earth Sciences, Faculty of Natural Sciences University of Silesia in Katowice, Sosnowiec, Poland;
[2] Institute of Biology, Biotechnology and Environmental Protection, Faculty of Natural Sciences University of Silesia in Katowice, Katowice, Poland;
[3] Molecular Evolution, Department of Cell and Molecular Biology, Biomedical Centre, Uppsala University, Uppsala, Sweden;
[4] Marian Smoluchowski Institute of Physics, Faculty of Physics, Astronomy and Applied Computer Science, Jagiellonian University, Kraków, Poland;
[5] Evolution and Development, Department of Organismal Biology, Uppsala University, Uppsala, Sweden;
[*] dawid.surmik@us.edu.pl – presenting author

Keywords: Dinosaur taphonomy, molecules, contaminations, fungi.

Fungi play a crucial role in processing dead organic matter. They are the primary decomposers in ecosystems, meaning they break down dead plant and animal tissues into simpler chemical compounds with specialized enzymes. Among the most essential fungal enzymes are proteases capable of decomposing proteins into smaller peptides and amino acids.
In molecular palaeontology, fungi are an undesirable factor influencing the interpretation of a find, because their presence may indicate that the preserved organic matter is not endogenous, but is a contaminant caused by the fungal activity. However, this assumption is incorrect, because the identification of fungi does not completely exclude the presence of endogenous compounds. In many cases, it is not possible to reliably demonstrate whether organic residues are endogenous in a good state of preservation, endogenous decomposed into simpler

substances, or exogenous. However, the ratio of these fractions will change with time and the degree of decomposition.

The results of interdisciplinary research have shown that exceptionally preserved tissues extracted from internal cavities of the Late Triassic theropod bones demonstrate a snapshot of the decomposition process of dinosaur soft tissues with the invasion of ascomycetes fungi with morphological types resembling *Scopulariopsis* spp. and *Penicillium* spp. We used both lactophenol cotton blue and ink and vinegar to dye the chitin present in the fungal cell walls blue. Thanks to this, we are able to identify inclusions of mycelial hyphae in the original vascular walls with optical microscope. We also applied scanning electron microscopy and imaging based on synchrotron techniques. In addition, we used time-of-flight secondary ion mass spectrometry (ToF-SIMS) to detect amino acids characteristic of vertebrate collagens and fungal-specified polysaccharides (chitin) and sterols (ergosterol). Initial molecular taphonomy studies have revealed a rather complex and unexpected composite of palaeomolecular and recent microbial records that are preserved in these bones and their interpretation is ongoing.

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[Poster] [non-student]

Applying machine learning to identify biological structures in demineralized fossil bone samples

Aleksander Białka[1], **Dawid Surmik**[2,*] & Aleksander Lamża[1]

[1] Institute of Computer and Information Sciences, Faculty of Science and Technology, University of Silesia in Katowice, Sosnowiec, Poland;
[2] Institute of Earth Sciences, Faculty of Natural Sciences, University of Silesia in Katowice, Sosnowiec, Poland;
[*] dawid.surmik@us.edu.pl – presenting author

Keywords: Artificial Intelligence (AI), python, deep learning, microscopy, dinosaurs.

Machine learning (ML) is being increasingly applied in natural sciences, and palaeontology is no exception. Image analysis and problem-solving algorithms can be helpful tools for automated screening of microscopy data (both already captured images as well as in real time) for quantitative and qualitative evaluation for the content of fossilized structures of biological character. These may be fragments of blood vessels, bone cells, and extracellular matrix, constituting endogenous structures in demineralized fossil bone, as well as aggregates of bacteria and fungi, constituting exogenous contamination.

We have attempted to prepare such algorithm model based on the Python programming language, using the TensorFlow framework (for building and training the ML model) and the OpenCV library (image preprocessing). The web graphical interface enabling interaction with the model will be implemented based on the Django framework. The model-training dataset are images obtained from scientific literature, unpublished data resources provided by the researchers, and images collected by us from our own samples. This interdisciplinary approach using applied computer science for palaeobiological research is the subject of the engineering thesis of the first author (AB).

Furthermore, we built a portable setup consisting of a single board computer Raspberry Pi equipped with quad-core ARM processor, 16 GB RAM, 512 GB NVME solid state drive, and 12.3 megapixel high-quality camera coupled with 26 TOPS (tera-operations per second) AI kit

with Hailo-8L accelerator. This computer setup can be connected to any optical microscope via C-mount or standard ocular eyepiece (Ø 23.2 mm). Therefore, it presented a small, very handy kit which can be taken everywhere and it has enough computing power to identify structures of interest in real time.

The expected result will be an application enabling classification of microscopic fossil bone samples in a deterministic manner.

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[Poster] [student]

Did temnospondyls get outcompeted to extinction by phytosaurs during the Triassic?

Dominik Świątek[1,*]

[1] Instytut Biologii, Wydział Przyrodniczo-Techniczny, Uniwersytet Opolski, Opole, Poland;
[*] dominik.pterus@gmail.com – presenting author

Keywords: Temnospondyli, Phytosauria, Triassic, competition.

Temnospondyls were a diverse group of early tetrapods, and inhabited a wide range of environments. They dominated the niche of semi-aquatic predators during the Permian and the beginning of the Triassic, but declined in diversity during the Late Triassic, eventually going extinct by the end of the Early Cretaceous. The exact reasons for their decline are still unknown. The Triassic was a time of many global climatic changes, which may have been responsible for their decline. During this time, there was also a significant radiation of archosauromorphs, some of which (for example, phytosaurs) adapted to a semi-aquatic lifestyle, and exploiting similar food sources to temnospondyls. Occurrence data from both of these groups shows, that they coexisted for some time in the same habitats, but also that, while the temnospondyl diversity declined in the Late Triassic, phytosaurs on the other hand increased in diversity. These data indicate the potential ecological and niche competition between these groups, which might imply that phytosaurs replaced temnospondyls in their ecological niche, and ultimately played an important role to their regression. Nevertheless, the temnospondyl diversity also responds to changes in climate.

[Poster] [non-student]

The apparatus composition of the *Ctenopolygnathus brevilaminus* (Conodonta) based on the natural assemblage from the Devonian of the Holy Cross Mountains, Poland

Przemysław Świś[1,2,*], Krzysztof Broda[3], Weronika Łaska[1], Dawid Dróżdż[4] & Piotr Duda[3]

[1] Faculty of Biology, University of Warsaw, Warsaw, Poland;
[2] Department of Chemical and Geological Sciences, University of Modena and Reggio Emilia, Italy;
[3] Formerly, Institute of Earth Sciences, Faculty of Natural Sciences of University of Silesia, Sosnowiec, Poland;
[4] Department of Evolutionary Paleobiology, Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[*] swis.przemyslaw@unimore.it – presenting author

Keywords: Conodont, element, apparatus, assemblage, Devonian.

Conodonts are among the most significant fossils used in biostratigraphy, palaeoclimatology, and geochemical studies. Despite their versatile role in modern geology and palaeobiology, their position in palaeoecosystems remains uncertain. Recently, increased efforts have been made to fill this gap by examining geochemical proxies for conodont diets and the morphology of P_1 elements (the caudalmost element of the conodont apparatus). However, conodonts are likely fed with a complex array of elements rather than just the rear P_1 elements, and most species lack fully reconstructed apparatuses. In fact, the conodont feeding apparatus comprises multiple element types (S, M, and P elements) arranged from the front to the back of the mouth, but complete or semi complete feeding apparatuses natural assemblages are exceptionally rare. Therefore, there is a need to reconstruct these structures using available data.

Herein, we present the apparatus of *Ctenopolygnathus brevilaminus*, based on a natural assemblage from the early Famenian (Late Devonian), *triangularis* Zone of the Kowala Quarry in the Holy Cross Mountains in Poland.

The assemblage (GIUS 4-3681/Kow182-2 [University of Silesia, Sosnowiec]), preserved on a 4.0 × 8.5 cm piece of shale slab. It includes seven visible conodont elements, four imprints, and two additional elements detected via micro-CT (microtomography) scanning. The best-preserved are two S_4 elements with elongated cusps and unusually long denticles, typical of ozarkodinids. These elements, along with a fragment of another S element, are dislocated, with the dextral series shifted dorsally. The asymmetrical S_0 element is partly visible, covering parts of the S array, but is missing from the 3D scan. Beneath the S_0 are paired P_2 elements with tightly opposed denticles, and P_1 elements at the terminal positions, mostly detectable via μCT scan, with caudally oriented blades and well-developed denticles. A nearby element fragment and an imprint may represent an unidentified S element. While M elements are absent on the surface, two possible M elements were detected deeper in the matrix by the μCT scan, though their inclusion in the assemblage remains uncertain due to their different spatial positioning.

The composition of this natural assemblage aligns with reconstructions based on isolated elements. The S-series of *Ctenopolygnathus brevilaminus* is unusually robust and slightly tilted caudally, a feature that may have prevented prey from escaping the oral cavity. The symmetrical S_0 in our specimen is positioned between $S_{1–2}$ and $S_{3–4}$, which is unusual. In previous studies, this element was interpreted as either the first or last in the S-series. We propose that this disparity arises from the S_0 element being mobile along the rostro-caudal axis, possibly serving to guide prey to the pharyngeal region. The described assemblage represents the first robust ozarkodinid apparatus that provides insights into the diversity of conodont feeding strategies.

[Talk] [non-student]

The ontogeny of the Late Devonian conodont *Tripodellus gracilis* based on growth increments

Przemysław Świś[1,2,*], Bryan Shirley[3,4] & Emilia Jarochowska[4]

[1] Faculty of Biology, University of Warsaw, Warsaw, Poland;
[2] Departament of Chemical and Geological Sciences, University of Modena and Reggio Emilia, Italy;
[3]Fachgruppe Paläoumwelt, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany;
[4] Department of Earth Sciences, Utrecht University, Utrecht, the Netherlands;
[*] swis.przemyslaw@unimore.it– presenting author

Keywords: Conodont, element, increment, ontogenesis, Devonian.

Conodonts are a group of extinct marine vertebrates that were present in seas from the late Cambrian to the earliest Jurassic. Due to their usefulness in biostratigraphy, evolutionary and paleoenvironmental studies, they are one of the groups crucial to our understanding of the past. Conodont elements, primarily composed of apatite, are distinguished by their crown tissue, which typically consists of lamellar tissue and white matter. Lamellar tissue is believed to grow through periodic secretion by epithelial cells likely in daily, monthly, or seasonal increments. White matter remains less understood, though it appears to form syntactically over existing lamellae and exhibits a unique porous structure with cylindrical tubes. These incremental growth patterns could be used as indicators of the age of an individual and allow insight into ontogenetic development, population dynamics, evolutionary trends, and environmental responses. These features make conodonts one of the most convenient fossils to trace life histories of individuals. The thickness of growth increments provides information about the relative growth rates of different parts of an element. The overall growth trajectory illustrates the morphogenesis of elements, which is not possible in hard tissues of other vertebrates.
The presented study investigates the ontogeny of the conodont species *Tripodellus gracilis*, focusing on morphogenesis and potential dietary shifts, especially during juvenile stages.

In result we confirm that the morphological changes in *Tripodellus gracilis* are reflected in growth increments. The arrangement of increments before platform development creates a crest that terminates the juvenile phase. The presence of this crest is unique to *Tripodellus gracilis* and probably its evolutionary development could be traced back to previous forms. We also see possible association of the white matter with the course of increments in higher contrast pictures. We confirmed that the increments formed bundles, which could be evidence of another cyclicity recorded in conodont hard tissue.

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[Talk] [non-student]

Taming a Mesozoic Menagerie: spatial documentation strategies for a complex fossil site

Barbara Szafron[1,*], Carl Mehling[1] & Andre Saleiro[2,3]

[1] American Museum of Natural History, New York, New York, USA;
[2] GEOBIOTEC, Department of Earth Sciences, NOVA School of Science and Technology, Universidade NOVA de Lisboa, Caparica, Portugal;
[3] Museu da Lourinhã, Lourinhã, Portugal;
[*] bszafron@amnh.org – presenting author

Keywords: Morrison Formation, field mapping, digitization.

Mapping a fossil quarry preserves critical information about the spatial distribution of specimens, essential for both palaeontological research and collection management. This project addresses the challenges encountered at the Dana BLM Quarry in Wyoming's Big Horn Basin. Excavated by the American Museum of Natural History since 2022, the site is a rich, densely packed Upper Jurassic Morrison Formation bonebed. It has yielded a wide variety of vertebrate taxa, including large sauropods, stegosaurs, medium-sized ornithopods, small theropods, pterosaurs, rhynchocephalians, turtles, and fish. Among the finds so far are at least two previously unidentified dinosaurs. Particularly significant is the abundance of small, delicate specimens, often underrepresented in the fossil record due to their fragility and the challenges of field recovery.

Given the high density of large, robust specimens clustered with small, fragile ones, traditional bone-by-bone mapping proved impractical. To retain contextual data, we employed minimal field exposure of fossil material, and instead documented the positions of field jackets, which often contained multiple unidentified elements. We measured the central coordinates of each jacket relative to permanent reference stakes, outlined them to scale on paper maps, and later digitized them with photo editing computer software.

This digital map compiles data across multiple excavation seasons. By creating separate layers, researchers can isolate specific taxonomic groups, such as theropod material, illuminating their

distributions across the quarry, while maintaining overall spatial relationships. As ongoing laboratory preparation refines specimen identifications, this digital system ensures that spatial context, even for fossils not visible during excavation, can be continually updated and preserved.

This approach safeguards critical contextual information, provides a flexible framework for analyzing faunal distribution, supports species identifications, and offers a model for documenting similarly complex fossil sites.

[Talk] [non-student]

Synchrotron tomography reveals new anatomical data on the early lizard *Megachirella* (Reptilia, Lepidosauria)

Mateusz Tałanda[1,*], Vincent Fernandez[2], Evelyn Kustatscher[3] & Roger Benson[4]

[1] University of Warsaw, Faculty of Biology, Biological and Chemical Research Centre, Institute of Evolutionary Biology, Warsaw, Poland;

[2] ESRF - The European Synchrotron, Grenoble, France;

[3] Museum of Nature South Tyrol, Bolzano, Italy;

[4] American Museum of Natural History, New York, New York, USA;

[*] m.talanda@uw.edu.pl – presenting author

Keywords: Lepidosauromorpha, Lepidosauria, Squamata, Middle Triassic.

Squamates (lizards, snakes, and amphisbaenians) are one of the most species rich vertebrate groups today. Very little is known about their origin, which is documented so far by only a handful of fossils. One of the earliest and the most complete is *Megachirella wachtleri* found in the Middle Triassic of the Dolomites (N-Italy). It consists of half of an articulated skeleton partially entombed in the rock matrix. Some previous studies suggested that it can be a stem-Squamate, the oldest currently known. However, other analyses suggested a more basal position, at the stem of Lepidosauria (Squamata + Rhynchocephalia). The debate over its phylogenetic position is difficult because many details of its anatomy remain obscure due to insufficient resolution of the previous CT-scan data. Here we present results from the high-resolution propagation phase contrast synchrotron X-ray micro computed tomography of the same specimen. It enabled us to revise previous interpretations and discover unknown features of this animal. For example, the palate bears teeth, while the postfrontal and postorbital are separate, and the latter is excluded from the upper temporal fenestra. We did not find any evidence for fusion of frontals and the element preserved probably represent only the right frontal. The new data will help us test the phylogenetic position of *Megachirella* as well as the relationships of other recently described Triassic diapsids.

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[Talk] [non-student]

Growth pattern variability among Late Triassic pseudosuchians (Reptilia, Archosauria)

Elżbieta M. Teschner[1,*]

[1] University of Opole, Institute of Biology, Opole, Poland;

[*] eteschner@uni.opole.pl – presenting author

Keywords: fibro-lamellar bone, lamellar-zonal bone, Triassic, palaeohistology, Pseudosuchia.

Palaeohistology can inform on growth dynamics, lifestyle or even basal metabolic rate of extinct vertebrates. There are two main bone tissue type, one is the fibro-lamellar bone complex (FLB), mostly found in dinosaurs (and birds) and many mammals. The other is the lamellar-zonal bone (LZB), usually found in (modern) amphibians and some reptile groups. FLB is built in a scaffold of successively deposited woven bone in combination with high vascularity (primary osteons), followed by parallel-fibred or lamellar bone, whereas LZB consists usually of low vascularised (simple vascular canals) parallel-fibred bone and lamellar bone. The Late Triassic was a time of transitions in form of climatic conditions and a following faunal turnover. A palaeohistological study of phytosaur, aetosaurs, and temnospondyls from the Upper Triassic Krasiejów site (Poland), revealed that despite being phylogenetically much distant relatives, all groups grew with the same growth pattern resembling LZB. Since previous studies showed the deposition of FLB or FLB with a later ontogenetic change into LZB in aetosaurs and phytosaurs from the USA and Argentina, this study aims to track the origin of FLB within the pseudosuchian lineage. The goal of this project is to answer whether the growth pattern was influenced by the local environment and/or climatic condition, since the European taxa grew distinctly different from North and South American taxa, if it is a response on the ontogeny or whether Late Triassic pseudosuchian show high developmental plasticity.

Funding: This research was funded by the Polish National Centre Sonatina grant no. UMO-2024/52/C/ST10/00111.

[Poster] [non-student]

Palaeohi(p)stology – first analysis of the pelvic elements of *Metoposaurus krasiejowensis* (Temnospondyli, Metoposauridae)

Elżbieta M. Teschner[1,*] , Andrea Prino[2,3] & Dorota Konietzko-Meier[4,5]

[1] Institute of Biology, University of Opole, Opole, Poland;
[2] Comparative Zoology, Institute of Biology, Humboldt University of Berlin, Berlin, Germany;

[3] Museum für Naturkunde, Leibniz-Institut für Evolutions-und Biodiversitätsforschung, Berlin, Germany;

[4] Stuttgart State Museum of Natural History, Stuttgart, Germany;

[5] Bonn Institute of Organismic Biology (BIOB-V), Section Palaeontology, University of Bonn, Bonn, Germany;
[*] eteschner@uni.opole.pl – presenting author

Keywords: Temnospondyli, ilium, ischium, growth pattern, Krasiejów.

The Late Triassic Krasiejów locality in southwestern Poland is remarkable in regards to the quality and quantity of the preserved fossil finds. Therefore, it gives the opportunity to carry out palaeohistological studies and makes the abundant metoposaurid temnospondyl *Metoposaurus krasiejowensis* possibly the best studied taxon histologically. As far as long bones are best suited for histological analyses, pelvic elements were believed to be histologically not useful. Here we studied ischia and ilia of *Metoposaurus krasiejowensis* in order to test whether their histological framework can provide information about skeletochronology and the intraskeletal variability. The samples originate from different ontogenetic stages. Microanatomically, all pelvic elements are porous, with a thin cortex, except for the midpart of the dorsal blade of the ilium. They are built of coarse parallel-fibred bone, and preserve growth marks in form of thick zones and unusually thick annuli, always hosting few rest lines. Interestingly, Lines of Arrested Growth (LAGs) are not present whereas Sharpey's fibres are common. Furthermore, the ischium preserves calcified cartilage. The histological framework is very similar to that known from long bones of *Metoposaurus krasiejowensis*. The extended presence of calcified cartilage indicates slow ossification of the endochondral domain. Finally, the low degree of compactness in all pelvic elements hints to a reduced function of the pelvic girdle and hind limbs in locomotion of *Metoposaurus*.

Funding: This research was funded by DFG Research Unit 5581 Evolution of life histories in early tetrapods.

[Poster] [non-student]

Occulta apparentia: coelacanthiform fish remains from the Late Triassic deposits of Krasiejów, Poland

Mateusz Antczak[1], Jakub Kowalski[1] & **Elżbieta M. Teschner**[1,*]

[1] Institute of Biology, University of Opole, Opole, Poland;

[*] eteschner@uni.opole.pl – presenting author

Keywords: Microvertebrates, scales, Sarcopterygii, teeth.

In the Late Triassic deposits of Krasiejów (southern Poland), remains of several fish groups have been described, including sharks, actinopterygians, and lungfishes. The morphological diversity of isolated scales and teeth suggests a high diversity of the ichthyofaunal assemblage; however, such microremains are often difficult to identify. Some scales, due to their distinctive ornamentation, can nonetheless be assigned to specific taxa.

Excavations at the site have been ongoing for over 20 years and continue to yield new discoveries. Here, we present isolated tooth-bearing elements and scales. The teeth can be classified into three distinct morphotypes, reflecting different positions within the oral cavity, though they cannot be assigned to specific taxa. The scales, on the other hand, exhibit a characteristic ornamentation consisting of hollow, tube-like ridges arranged along the anteroposterior axis of the scale, allowing identification at the genus level.

The assignment of these remains to the genus *Diplurus*, previously known only from the Newark Supergroup (USA), opens new palaeobiogeographic perspectives on the dispersal of freshwater taxa across the epicontinental sea that once separated what is now the eastern United States of America and Central Europe.

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[Talk] [student]

Surface analysis of the proximal epiphyseal growth plate in the humeri of mammals

Roberta Vakruchev[1,*], Sifra Bijl[1], Jordi Estefa[1], François Clarac[1,3], Jasper Ponstein[1,4], Paul Tafforeau[2], Anusuya Chinsamy-Turan[5] & Sophie Sanchez[1]

[1] Department of Organismal Biology, Uppsala University, Uppsala, Sweden;
[2] European Synchrotron Radiation Facility, Grenoble, France;
[3] Muséum national d'Histoire naturelle, Paris, France;
[4] Humboldt-Universität zu Berlin and Museum für Naturkunde Berlin, Berlin, Germany;
[5] Department of Biological Sciences, University of Cape Town, Cape Town, South Africa;
[*] roberta.vakruchev@ebc.uu.se – presenting author

Keywords: *Galesaurus*, Mammalia, epiphyseal growth plates, limb-bone elongation, morphology.

The success of mammals' radiation is due in part to their locomotory adaptations to all types of ecological niches. This largely relies on their great diversity of limb morphologies. Elongation of limb bones occurs at each end of the bone shaft through the development of the epiphyseal growth zone. Above the cartilaginous growth plate, secondary ossification centres form bony epiphyses, eventually fusing with the plate and marking the end of bone elongation. The morphology of the proximal growth plate differs across Mammalia, with varying peaks and grooves across the cartilaginous surface. Although the process of limb-bone elongation is well understood, there has been limited research on the growth plate surface morphology and what factors may be influencing it (such as ecology, phylogeny, or ontogeny). Using synchrotron propagation phase-contrast X-ray microtomography, we reconstructed 3D models of the growth plate surface at the proximal end of the humerus in several extant mammals and one stem mammal, the Early Triassic cynodont *Galesaurus planiceps*. We then applied a metric called ariaDNE, originally developed for tooth morphology, to quantify and measure the curvatures of these surfaces. Our findings show that there was a high diversity of growth plate morphologies across mammal species. Within the same species, the morphology appears to shift

throughout different ontogenetic stages, with a trend towards higher complexity in later developmental stages. Interestingly, the fossil specimen, *Galesaurus planiceps* had a growth plate morphology that is remarkably similar to the short-beaked echidna (*Tachyglossus aculeatus*). Preliminary statistical tests suggest that growth plate morphology may be influenced by phylogeny and locomotory mode. In order to test these preliminary data and find significant patterns, the sample size will be expanded. However, this study has shown how ariaDNE could be adapted for a variety of surfaces and points out areas for improvement in the development of this method. This study also demonstrates that growth plate surface morphology should be further explored due to its potential palaeobiological applications for the interpretation of the ecology and evolution of extinct mammals and their stem group.

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[Talk] [student]

Using artificial intelligence for 2D dental microwear analysis of European Middle Triassic marine vertebrates

Ivo van der Beek[1,*], Djurre van der Molen[1], Carlos Martinez-Perez[2], Anne Schulp[1,3], Femke Holwerda[1] & Emilia Jarochowska[1]

[1] Department of Earth Sciences, Utrecht University, Utrecht, The Netherlands;

[2] Department of Geology, University of Valencia, Valencia, Spain;

[3] Naturalis Biodiversity Center, Leiden, The Netherlands

[*] I.r.vanderbeek@uu.nl – presenting author

Keywords: Dental microwear, microfossil, Osteichthyes, Chondrichthyes, Sauropterygia.

In order to better understand the trophic interactions in marine ecosystems during the Middle Triassic, this study applies 2D dental microwear analysis to two European microfossil assemblages. The two localities analysed for this project are the Anisian of Winterswijk (The Netherlands) and the Ladinian of Henarejos (Spain). The teeth from the assemblages consist mostly of Chondrichthyes, Osteichthyes, and marine reptiles. Dating from roughly 7 (Winterswijk) to 20 (Henarejos) million years after the Permian–Triassic mass extinction, these assemblages offer valuable insights into the functioning of marine ecosystems after the extinction. The teeth were obtained by acid extraction, sieving and picking under a light microscope.

Dental microwear features were imaged using scanning electron microscopy (SEM). Manually identifying and counting microwear features is labour-intensive and introduces observer bias. To combat these issues, an Artificial Intelligence (AI) model is being developed. The AI model is being trained to identify and quantify 2D microwear features (e.g., pits, scratches, feature size) from the SEM images. The model aims to reduce observer bias and increase the reproducibility of 2D microwear analysis. Where necessary, manual assessment will supplement the AI-derived data. The model will be released as an open-source tool accessible to everyone. By reducing the time investment required for 2D dental microwear analysis, this

tool aims to make the method more efficient and widely applicable for the reconstruction of trophic interactions.

Microwear patterns will be compared across taxa and between Winterswijk and Henarejos. Based on these patterns and other dietary proxies (for example, see Lily Hardeveld Ook Genaamd Kleuver et al. abstract, this volume), diets will be inferred, providing input for the reconstruction of the trophic web. These reconstructed trophic relationships can reveal whether taxa present both in Winterswijk and Henarejos (e.g., *Gyrolepis*, *Saurichthys*) occupy similar dietary niches across space and time.

[Poster] [non-student]

The first report of an Early Pliocene cryptobranchid amphibian (Urodela, Cryptobranchidae) from eastern Romania

Ștefan Vasile[1,*] & Márton Venczel[2]

[1] University of Bucharest, Faculty of Geology and Geophysics, Department of Geology, Mineralogy, and Palaeontology, Bucharest, Romania;

[2] Țării Crișurilor Museum, Department of Natural Sciences, Oradea, Romania;

[*] yokozuna_uz@yahoo.com – presenting author

Keywords: Amphibia, Urodela, vertebral morphology, Pliocene, Romania.

The fluvio-lacustrine deposits of Bereşti and Măluşteni, two neighbouring localities in eastern Romania, have yielded the most diverse Pliocene fossil asemblage known so far from the entire Romanian territory. The faunal assemblages from the two sites are best known for the mammal taxa, including both large and small taxa. The latter material helped estimate the age of the two assemblages to Early–early Late Pliocene (MN 14–15) for Bereşti and mid-Early Pliocene (MN 14) for Măluşteni. Ectothermic vertebrates from these assemblage were less known until recently, but include cyprinid, silurid, esocid, salmonid, percid, and sparid fishes, a large viperid (*Macrovipera* sp.), and the large anguid *Pseudopus pannonicus*.

A closer inspection of old collections led to the identification of a single amphibian specimen from Bereşti, consisting in a large amphicoelous trunk vertebra preserving the centrum (20.70 mm long) and most of the neural arch, but missing the prezygapophyses, the left distal part of the postzygapophysis and the distal parts of the transverse processes. The anterior and posterior cotyles are circular. The vaulted neural arch rises abruptly posteriorly and it bears a distinct yet not salient neural crest. A single large anteroposteriorly elongated central foramen is present clearly visible on the ventral surface of the centrum, left of the thin and low haemal keel. Numerous small pits cover most of the vertebral surface, being most noticeable on the ventral and lateral sides.

In spite of only one incomplete vertebra being present, its morphological features closely resemble those described for the large-sized cryptobranchid taxon *Andrias scheuchzeri*. The presence of this specimen in the Lower Pliocene deposits from Bereşti makes it one of the geologically youngest occurences of the taxon in Central and Eastern Europe, adding more information on its geographic and stratigraphic range.

[Poster] [student]

The first Middle Triassic ichthyopterygian (Reptilia, Diapsida) from Croatia

Fran Vidaković[1,*], Andrzej S. Wolniewicz[2,3], Aleksandar Mezga[1], Dražen Japundžić[4], Robert Šamarija[5], Tea Kolar-Jurkovšek[6] & Daniel J. Field[2,7]

[1] Department of Geology, Faculty of Science, University of Zagreb, Zagreb, Croatia;

[2] Department of Earth Sciences, University of Cambridge, Cambridge, United Kingdom;

[3] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[4] Department of Geology and Palaeontology, Croatian Natural History Museum, Zagreb, Croatia;

[5] Institute of Applied Geosciences (AGW) – General Geology, Karlsruhe Institute of Technology, Karlsruhe, Germany;

[6] Geological Survey of Slovenia, Ljubljana, Slovenia;

7 Museum of Zoology, University of Cambridge, Cambridge, United Kingdom;

[*] fran.vidakovic@geol.pmf.hr – presenting author

Keywords: Ichthyopterygia, Triassic, Croatia, biostratigraphy, palaeobiogeography.

The Žumberak Mountains are situated in northwestern Croatia, where they represent a part of the Internal Dinarides. A substantial exposure of Triassic sedimentary rock is present in this area, most of which comprises poorly to non-fossiliferous dolostones formed on a carbonate platform. However, a relatively thin Middle Triassic deep-water basinal succession comprising cherts, various clastic and pyroclastic lithologies, as well as carbonates is also present in the area. This succession has produced various microfossils, such as radiolarians, as well as cephalopod fossils, but remains relatively poorly studied.

In 2021, an ex-situ limestone boulder containing fossilized bones of a marine reptile was recovered from this region. Preparation of the specimen (HPM 10994, housed in the Croatian Natural History Museum, Zagreb) reveals that it represents six vertebral centra, two neural arches, at least ten partial ribs and several gastral rib fragments of an ichthyopterygian. The vertebral centra are partially articulated, but the ribs are rotated out of their life position counter-clockwise. Although the remains are fragmentary, the available information indicates that the

specimen is similar to the vertebrae typically referred to the geographically widespread Middle Triassic genus *Cymbospondylus*.

Samples taken from the rock matrix enabled the characterization of the microfacies of the host rock. Additionally, chemical extraction yielded associated microfossils, including the fragments of osteichthyans and chondrichthyans, conodont elements, foraminifera, and poorly preserved radiolarians. Taken together, this enables the reconstruction of the paleoenvironment of the specimen as a deeper-marine setting with a non-platform benthic fauna that was reworked but likely not resedimented, a marked presence of planktic and nektonic organisms, and an influx of non-carbonate (likely pyroclastic) material.

The obtained conodont fauna places the ichthyopterygian specimen within the *Trammeri* Zone, encompassing the Anisan–Ladinian boundary, which is stratigraphically congruent with its putative cymbospondylid identity. This is the first occurrence of an ichthyopterygian from Croatia and from the Dinarides in general. As such, this specimen is valuable as an important palaeobiogeographic data point for the distribution of Triassic ichthyopterygians, and its presence calls attention to the further study of the Middle Triassic strata exposed on the Žumberak Mountains.

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[Poster] [non-student]

Review of *Antarctosaurus wichmannianus* (Sauropoda, Titanosauria) from the Late Cretaceous of Patagonia: insights into the osteology and histology

Bernat Vila[1,2,*], Albert Sellés[1,2] & Agustín G. Martinelli[3]

[1] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain;
[2] Museu de la Conca Dellà, Lleida, Spain.
[3] CONICET-Sección Paleontología de Vertebrados, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Ciudad Autónoma de Buenos Aires, Argentina;
[*] bernat.vila@icp.cat – presenting author

Keywords: titanosaurs, *Antarctosaurus*, Friedrich von Huene, Richard Wichmann, Argentina.

Antarctosaurus wichmannianus is an iconic sauropod taxon, discovered by the geologist Richard Wichmann in 1912 in Río Negro (Argentina). This titanosaur species was originally described by the eminent palaeontologist Friedrich von Huene, based on part of the material recovered from the 'Valle de la Luna rojo' locality. Despite representing one of the first titanosaurs with cranial remains and preserving several associated postcranial elements, its systematic position was problematic, and it has been rarely included in the phylogenies of the clade. Here we present a comprehensive review of the material housed at the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" in Buenos Aires (Argentina), along with unpublished historical documents from the original fieldwork. These sources confirm that among the specimens originally collected by Wichmann in 1912, there were additional elements that were not described by Huene in 1929. The osteological analysis of all the recovered specimens, including the 3D modelling of about 50 elements, reveals size variability in some repeating elements. Notable differences in discrete characters and/or size in metacarpals, metatarsals, astragali, and pedal phalanges suggest the presence of at least two individuals of distinct ontogenetic ages within the collection. The body size analysis based on the femur (using the empirical scaling relationship of limb robustness with body mass) indicates that the holotype and the largest *Antarctosaurus wichmannianus* specimen was an individual of moderate size,

with an estimated body mass of about 12 tonnes and a body length of 16 meters. Osteohistological analysis further suggests that this individual still had not reached full skeletal maturity at the time of death (Histologic Ontogenetic Stage 8–9). Rapid growth and an intensive secondary remodelling earlier in ontogeny is indicated by the presence of laminar and plexiform woven-parallel complexes in the middle and outer cortex and of scattered secondary osteons in the middle cortex (type D-E bone tissues), the absence of an external fundamental system in the outer cortex, and an extensive Haversian tissue in the inner cortex. Thus, we conclude that the largest individual of *Antarctosaurus wichmannianus* may represent a sexually mature but still-growing early adult animal.

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[Talk] [non-student]

A gigantic long-necked titanosaur (Dinosauria, Sauropoda) from the Late Cretaceous of Ibero-Armorica (SW Europe)

Bernat Vila[1,2,*], Albert Sellés[1,2] & Giancarlo J. Olmedo[1]

[1] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain;

[2] Museu de la Conca Dellà, Lleida, Spain;

[*] bernat.vila@icp.cat – presenting author

Keywords: Titanosauria, Late Cretaceous, Europe, osteohistology.

Recent investigations of the temporal distribution of dinosaurs in southwestern Europe have revealed significant disparity in body size among titanosaurian sauropods from the Ibero-Armorican island. Current data suggest that the late Campanian–early Maastrichtian assemblage composed of small- and medium-sized taxa was replaced by an early–late Maastrichtian assemblage of distinctively large-bodied taxa, with a coexistence time around the early Maastrichtian. Here we report a new sauropod specimen from the new Les Gavarres locality (lower Maastrichtian, Tremp Basin, Catalonia, Spain), which provides further support for the presence of gigantic titanosaurs at the end of the Cretaceous in Europe. The specimen comprises a partial forelimb (complete humerus and ulna, and three metacarpals) and an associated cervical rib from a single individual. The most striking character is its gigantic size, with proximodistal lengths of humerus and ulna (1420 mm and 950 mm, respectively) and estimated body mass and length (21.5 tonnes and 25 m, respectively) notably exceeding the respective sizes of all known Campanian and Maastrichtian titanosaurs from the European archipelago, Africa, and Asia, and matching the size of some large-sized and coeval genera of the Americas (*Alamosaurus*, *Argyrosaurus*). As for the growth, osteohistological analysis of the humerus reveals a fully remodelled cortex dominated by Haversian tissue (Histologic Ontogenetic Stage 13) and several generations of secondary osteons (Remodeling Stage 8), and absence of primary tissue, indicating an individual with an advanced stage of somatic maturity.

We also conducted a biomechanical analysis, estimating the lines of action and moment arms in the humerus-ulna complex, which provides insights into the mechanical advantage and muscle strength of the forelimb during locomotion. Finally, the preserved cervical rib segment is extremely long by recorded titanosaur standards (estimated total length 2140 mm) and together with the estimated total forelimb height (> 3.5 m) clearly predicts a tall, long-necked species that would likely have reached the canopy vegetation.

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[Poster] [non-student]

Osteohistological analysis of appendicular elements referred to *Lirainosaurus astibiae* (Sauropoda, Titanosauria) from the Laño locality (Iberia)

Bernat Vila[1,2,*], Albert Sellés[1,2] & Xabier Pereda-Suberbiola[3]

[1] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Sabadell, Barcelona, Spain;
[2] Museu de la Conca Dellà, Lleida, Spain;
[3] Departamento de Geología, Facultad de Ciencia y Tecnología, Universidad del País Vasco/Euskal Herriko Unibertsitatea, Leioa, Spain;
* bernat.vila@icp.cat – presenting author

Keywords: Dinosauria, *Lirainosaurus*, Late Cretaceous, growth, osteohistology.

Lirainosaurus astibiae, from the upper Campanian bonebed of Laño (Condado de Treviño), was the first titanosaur species described in Spain. It represents a derived saltasaurid, probably belonging to the endemic European lineage, with its small size being its most striking characteristic. The osteohistology for *Lirainosaurus* was first provided by Company in 2011, based on the analysis of limb bones referred to the species recovered from the Chera site (Valencia province; south-eastern Spain). In the present work, we present the first osteohistological data obtained from limb bones of individuals from the type locality. The samples were obtained by drilling the posterior side of three femora housed at the Museo de Ciencias Naturales de Álava in Vitoria Gasteiz (Basque Country). Two of the femora have a similar proximodistal length and may represent elements from a single individual of approximately 83% of the maximum known length in the Laño sample (represented by the third examined femur). Body size estimations for the individuals based on these elements, using the empirical scaling relationship of limb robustness with body mass, indicate that they were small animals, with an estimated body mass and body length ranges of 1,700-2,800 kg and 4-6 m, respectively. The bone microstructure of the smaller femora exhibits nearly identical

characteristics: an extensive bone remodelling (Haversian bone), as evidenced by the presence of multiple generations of secondary osteons (remodeling stage 5-6) which extend nearly to the outermost cortex and largely obliterate the primary bone tissue. The latter is composed in the outer cortex of laminar and plexiform woven-parallel complexes with extremely low vascularization. Both specimens lack an external fundamental system in the outermost cortex, and one of them exhibits three growth marks in the periosteal region, including both lines of arrested growth and annuli. This combination of features corresponds to bone tissue types E and F, indicative of Histologic Ontogenetic Stage 11 and correlated with an adult age. The largest femur shows a very extensive bone remodelling (Haversian bone) throughout the cortex, clearly suggesting an advanced mature adult age. Integration of all histological data indicates that early in the ontogeny of *Lirainosaurus,* limb bones grew relatively fast, only to be reconstructed and decelerated in early adulthood. Moreover, this indicates an advanced or very advanced age at the time of death of the *Lirainosaurus* individuals from the holotype Laño locality, a feature shared with specimens from the Chera locality.

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[Poster] [student]

A reassessment of traditional 2D microwear analysis and its application to dinosaur teeth

Bernat-Josep Vázquez López[1,2], **Bernat Vila**[1,2,*] & Albert Prieto-Márquez[1,2]

[1] Institut Català de Paleontologia Miquel Crusafont (ICP-CERCA), Universitat Autònoma de Barcelona, Sabadell, Spain;
[2] Museu de la Conca Dellà, Isona, Spain;
[*] bernat.vila@icp.cat – presenting author

Keywords: Dinosauria, Cretaceous, dental, diet, Europe.

Three-dimensional dental microwear analysis techniques, like Dental Microwear Texture Analysis (DMTA), have gained popularity over traditional 2D SEM imaging because it produces more quantitative results and it facilitates comparison with published analyses, allowing for precise assignment of dietary categories. However, its cost is higher compared to traditional SEM imaging, and most of its interpretative benefits have only been validated in mammals. Most of the limited number of microwear studies on dinosaurs have been based on traditional 2D imaging. Even in mammals, traditional 2D techniques present only a handful of common microwear variables that vary greatly among studies, hindering interpretation, especially since most analyses have focused on only one or two groups. We present a preliminary consensus among numerous variables culled from the literature, using the most complete 2D multivariate microwear analysis to date on dinosaur teeth, including three different groups at the same time. A major challenge encountered when analysing dinosaur dental microwear is that most earlier studies have dealt with mammalian taxa. However, mammalian teeth are morphologically and functionally different from those of dinosaurs. There is no clear modern analogue for dinosaur dentition, considering that those of modern archosaurs are different, especially when compared to phytophagous dinosaur groups. Moreover, the browser-grazer dietary spectrum generally used for mammals cannot be confidently applied to dinosaurs. Grasses were just becoming widespread during the Late Cretaceous and probably were not the main food source of dinosaurs. This is why most microwear studies in dinosaurs assumed that

all groups were browsers. To overcome this broad classification scheme, we use a hard-object browser-mixed feeder-folivore spectrum in which a dietary category can be qualitatively assigned to each of the studied dinosaur groups. The results are statistically quantified to ascertain which variables are truly explaining the variation in dinosaur microwear. We use hierarchical ANOVA, followed by LDA (linear discriminant analysis), PCA (principal component analysis), and NMDS (non-parametric multidimensional scaling) analysis in order to reduce dimensions and discard statistically redundant variables. This approach holds great promise for using traditional 2D microwear analysis as an alternative or complement to DMTA.

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[Poster] [student]

Investigating functional variation in proboscidean limb morphotypes with Finite Element Analysis under compression

Nicolas Wagner[1,2,*], Narimane Chatar[3] & Jesse Hennekam[1]

[1] Maastricht Science Programme, Maastricht University, Maastricht, The Netherlands;

[2] Staatliches Museum für Naturkunde Stuttgart, Stuttgart, Germany;

[3] University of California Berkeley, Berkeley, USA;

* nicolaswagner.university@gmail.com – presenting author

Keywords: Proboscidea, Finite Element Analysis, functional morphology, Pleistocene, compression.

Proboscideans (e.g., elephants, mammoths, and mastodonts) include some of the largest known land mammals. Their limbs evolved a columnar structure and unique reorientation to withstand extreme vertical compression. Recent studies identified two distinct limb morphotypes—robust and gracile—independent of body mass, raising questions about their functional differences under compressive loads. To explore the functional implications of these morphotypes, we used finite element analysis (FEA) to simulate compressive forces on proboscidean humeri. Our results show that the broader, more robust morphotype resists compressive stress more effectively than the slimmer morphotype, suggesting functional specialisations in load-bearing strategies. While FEA is rarely applied to bone compression tests, our findings highlight its potential for investigating biomechanical adaptations in graviportal species. This study enhances our understanding of proboscidean limb evolution and establishes a methodological framework applicable to other large-bodied taxa, such as sauropod dinosaurs.

[Poster] [student]

A new skeleton of the booid snake *Eoconstrictor barnesi* (Serpentes, Constrictores) from the Eocene Konservat-Lagerstätte of Geiseltal, Germany

Kacper Węgrzyn[1,*], Krister T. Smith[2,3], Alessandro Palci[4], Oliver Wings[5,6], Márton Rabi[6,7], Roberto Rozzi[6,8] & Georgios L. Georgalis[1]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;
[2] Department of Messel Research and Mammalogy, Senckenberg Research Institute, Frankfurt am Main, Germany;
[3] Faculty of Biosciences, Goethe University, Frankfurt am Main, Germany;
[4] College of Science and Engineering, Flinders University, Adelaide, South Australia, Australia;
[5] SNSB, Natural History Museum Bamberg, Bamberg, Germany;
[6] Natural Sciences Collections, Martin Luther University Halle-Wittenberg, Halle (Saale), Germany;
[7] Department of Geosciences, Eberhard Karls Universität Tübingen, Tübingen, Germany;
[8] Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Berlin, Germany;
[*] kajperwegrzyn@gmail.com – presenting author

Keywords: Squamata, Serpentes, Constrictores, taxonomy, μCT scanning.

Fossil record from the Eocene epoch offers a unique glimpse into lost ecosystems, something that is particularly evident and vivid in the so-called Konservat-Lagerstätten localities, which are among the most important sources for exceptionally preserved vertebrate fossils. Here we document a previously undescribed snake skeleton (GMH XXII-586-1965) from the late early to early middle Eocene of Geiseltal, Germany, housed in the Geiseltal collection of the Martin Luther University Halle-Wittenberg. This articulated skeleton was identified as belonging to *Eoconstrictor barnesi*, a medium-sized booid snake. The genus *Eoconstrictor* currently comprises three described species: *Eoconstrictor fischeri* from Messel, and *Eoconstrictor*

spinifer and *Eoconstrictor barnesi*, both from Geiseltal. The third species, *Eoconstrictor barnesi*, was originally recently described based on two exceptionally well-preserved specimens. Using high-resolution µCT scanning on the skeleton GMH XXII-586-1965, we conducted a detailed investigation of its osteology, which allowed us to assess cranial and postcranial anatomy, intraspecific variation, and further explore ontogenetic patterns through direct comparison with the previously two known specimens of this species. Most notably, our documentation of GMH XXII-586-1965 reveals novel anatomical features, such as the presence of two maxillary foramina (instead of one that was so far diagnostic for the species), and provides new data on the morphology of the basioccipital, a bone which is missing in the holotype and badly damaged in the paratype of this species. These findings not only expand our knowledge of *Eoconstrictor barnesi* but also highlight the need to reassess other Geiseltal snake fossils, some of which may have been previously assigned as *Eoconstrictor* cf. *fischeri*. Finally, our investigation demonstrates that, despite intensive research in the past decades, the Geiseltal Collection continues to yield scientifically valuable material, especially when examined using modern imaging techniques like µCT scanning.

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[Poster] [student]

Report of multi-causal shell abnormalities in the of the Late Cretaceous turtle *Mongolemys elegans* (Testudines, Pan-Testudinoidea)

Tomasz Szczygielski[1], **Kacper Węgrzyn**[2,*], Justyna Słowiak[1] & Dawid Surmik[3]

[1]Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[2]Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;
[3]Institute of Earth Sciences, Faculty of Natural Sciences, University of Silesia, Sosnowiec, Poland;
[*] kajperwegrzyn@gmail.com – presenting author

Keywords: Testudines, Nemegt Formation, palaeopathology, ectoparasites.

Predation, infections, and parasitism are common factors in modern ecosystems, shaping ecological interactions, population dynamics, competition, and survival rates of vertebrates not only today but also in the past. Traces of interactions between organisms can often be detected in the fossil record as trauma- or disease-induced bone modifications. However, sometimes those palaeopathologies are overlooked, as was the case of the fossils from the Nemegt Formation in Mongolia. Excavations in this Late Cretaceous formation have provided numerous, well-preserved specimens of different taxonomic groups (e.g., reptiles, birds, mammals), rendering this assemblage one of the best known palaeoecosystems of the Mesozoic era. Herein, we focused on diverse multi-causal shell pathologies in *Mongolemys elegans*, a relatively common, freshwater lindholmemydid (Pan-Testudinoidea) turtle from the Nemegt Formation. A revision of multiple specimens reveals occurrence of several types of shell pathologies, mostly variable pits, lesions, grooves, microbial traces, and bite marks. Some of these abnormalities are caused by biological agents, like leeches, the activity of which leaves specific marks on the shell that can be classified into ichnotaxa. We report the presence of several ichnospecies, i.e., *Gunnellichnus akolouthiste*, *Gunnellichnus moghraensis*, *Nihilichnus nihilicus*, *Karetharichnus lakkos*, and *Thatchtelithichnus holmani*. Abnormalities of bone and

scutes were also observed. One abnormality is particularly interesting, because it documents an extensive localized modification of carapace texture, layout of scute sulci, and partial obliteration of sutures between bones, and thus appears to be most comparable with a thermal-burn scar – a pathology quite frequent in some natural populations of modern turtles, but relatively poorly documented from the osteological standpoint. These findings provide a deeper insight into the life of *Mongolemys elegans* and significantly increase our knowledge regarding shell lesions in fossil turtles, and what such pathologies say about the environment (water conditions favourable to leeches).

[Talk] [student]

New finds of Late Jurassic vertebrates from Owadów-Brzezinki site, central Poland

Łukasz Weryński[1,*] & Błażej Błażejowski[2,3]

[1] Doctoral School of Exact and Natural Sciences, Institute of Geological Sciences, Jagiellonian University, Kraków, Poland;
[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[3] Museum of Earth, Polish Academy of Sciences, Warsaw, Poland;
[*] lukaszwerynski@doctoral.uj.edu.pl – presenting author

Keywords: Jurassic, Tithonian, Ichthyosauria, Crocodylomorpha, Actinopterygii.

For over a decade, extensive excavation work has been conducted at the Owadów-Brzezinki site. As a result, hundreds of well-preserved fossils of various organisms have been recovered. In terms of both quantity and quality, they are unmatched in Central-Eastern Europe, rendering Owadów-Brzezinki a unique window into the biodiversity of the Late Jurassic (Tithonian) in this region of the continent. Discoveries from the site have revolutionised research on Jurassic vertebrates in Poland, as for the first time we have access to such numerous, locally-sourced findings that will continue to be analysed for many years to come. Among the most spectacular finds are certainly the remains of ichthyosaurs of the family Ophthalmosauridae. The holotype of one species described from the site, *Undorosaurus kielanae*, was until recently the only relatively complete and articulated specimen of that ichthyosaur species. However, our collection has recently been enriched with an articulated section of the axial skeleton, representing the distal region of the back and tail.

Although the sedimentary sequence in Owadów-Brzezinki is marine, terrestrial organisms are also present – including a crocodylomorph belonging to the family Atoposauridae. With the aid of micro-computed tomography (μCT) scanning, certain features of its cranial anatomy were assessed and lead us to consider the Owadów-Brzezinki atoposaurid as a new taxon. The

observed anatomical features of the skull and dentition suggest adaptations to an opportunistic, terrestrial lifestyle.

The finds of ray-finned fish at the site are very numerous, although mostly fragmentary. Among the most spectacular are the large fragmentary bones of predatory fish of the clades Pachycormidae and Halecomorphi. Exceptionally well-preserved dentigerous jaw bones of fish of the order Pycnodontiformes display a wide range of sizes. CT scans of these specimens shed new light on the durophagous adaptations of their dentition. Isolated, enigmatic sets of ray-finned fish teeth – resembling the pharyngeal teeth of Halecomorphi – will require further comparative research. In contrast to these numerous but fragmentary finds, the first nearly complete specimen of a teleost fish is noteworthy and will certainly attract interest of the scientific community.

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[Poster] [student]

The first occurrence of *Strophodus* (Chondrichthyes, Hybodontiformes) in the Jurassic of southern Poland: iron-mediated taphonomy of tooth histology

Łukasz Weryński[1,*] & Bogusław Kołodziej[2]

[1] Doctoral School of Exact and Natural Sciences, Institute of Geological Sciences, Jagiellonian University, Kraków, Poland;

[2] Institute of Geological Sciences, Jagiellonian University, Kraków, Poland;

[*] lukaszwerynski@doctoral.uj.edu.pl – presenting author

Keywords: Middle Jurassic, Chondrichthyes, Hybodontiformes, histology, taphonomy.

Hybodontiformes were one of the most successful Late Paleozoic and Mesozoic lineages of fossil chondrichthyans, inhibiting both saltwater and freshwater environments, occupying mesopredatory and durophagous niches. *Strophodus* was one of the largest hybodonts, characterised by its specialised crushing dentition and achieved a worldwide distribution, being one of the most successful and widespread hybodontiform taxa. As it regards southern Poland, Hybodontiformes have been reported mainly from the Triassic and so far occurrences of the *Strophodus* genus have been reported from western Pomerania.

Herein we report the first occurrence of an hybodont referred to *Strophodus* from the Middle Jurassic (lower Callovian) sandy limestones of Stradlina gorge near Dubie (Kraków Upland, southern Poland), based on an isolated tooth (ING/PAL/VERT/KR-1) housed at the vertebrate palaeontology collections of the Jagiellonian University, Institute of Geological Sciences. The size of the specimen, over 4 cm in length across the widest diameter, implies a large animal, and based on the proportions and overall morphology we interpret this tooth as likely belonging to the lateral tooth row.

Although the enameloid surface is strongly abraded, impeding species identification, ING/PAL/VERT/KR-1 is notable for its taphonomy. The specimen is characterised by well-preserved osteodentine histology, with individual denteons visible and highlighted by iron mineralisation. Under the scanning electron microscope, the surface of the tooth exhibits structures, interpreted herein as bacterial colonisation, with a coccus-like morphology. Excellent microstructure preservation is interpreted herein as related to iron-mediated taphonomical processes. So far, to our knowledge, such well-preserved histology has not been recorded in teeth of hybodonts from the Jurassic of Poland.

[Poster] [student]

Endocranial morphology of dome-headed dinosaurs (Dinosauria, Pachycephalosauria)

Wiktoria Wieliczko[1,2,*], Sergi López-Torres[1] & Justyna Słowiak[2]

[1] Faculty of Biology, University of Warsaw, Warsaw, Poland;

[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[*] wk.wieliczko@student.uw.edu.pl – presenting author

Keywords: Ornithischia, *Prenocephale*, endocranial morphology, olfactory bulbs, inner ear.

Pachycephalosauria is a clade of medium-sized herbivorous ornithischian dinosaurs that inhabited North America and Asia during the Late Cretaceous. They are known for their distinctive domed skulls, suggesting that they may have performed head-butting behavior. However, the internal structure of their skulls remains poorly understood, making it difficult to assess their sensory development compared to other ornithischians. This study focuses on the holotype specimen of *Prenocephale prenes* (ZPAL [Institute of Paleobiology, Polish Academy of Sciences, Warsaw] MgD-I/104) from the Maastrichtian of the Gobi Desert in Mongolia. Using computed tomography and the Avizo software, we reconstructed the braincase and inner ear. The reconstructed structures were then compared with previously published endocasts of two other pachycephalosaurs: *Stegoceras validum* (UALVP [University of Alberta Museums, Laboratory for Vertebrate Palaeontology, Edmonton] 2) and *Pachycephalosaurus wyomingensis* (USNM [Smithsonian National Museum of Natural History] 264304). Results indicate that all three species exhibited well-developed olfactory bulbs, suggesting an enhanced sense of smell. *Prenocephale prenes* had longer and thinner semicircular canals than *Stegoceras validum*, with the vertical semicircular canals having particularly greater radii. This suggests a substantial range of head movements along the vertical axis, probably associated with dynamic head movements due to head-butting behavior. In addition, the anterior regions of the cerebral hemispheres in *Prenocephale prenes* were pointed, similar to those seen in the endocast of *Pachycephalosaurus wyomingensis*. A comprehensive analysis of the endocranial morphology of *Prenocephale* is crucial to better understand pachycephalosaur behavior, particularly with respect to the cranial adaptations required to withstand significant impact forces.

[Talk] [non-student]

Mammoth bone accumulations in Central Europe – notes in the margin of the ERC MAMBA project

Jarosław Wilczyński[1,*], Martin Novák[2], Marc Händel[3]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[2] Archeologicky Ustav Av Cr Brno, AU Brno, Czechia;

[3] Oesterreichische Akademie Der Wissenschaften, Vienna, Austria;

[*] wilczynski@isez.pan.krakow.pl – presenting author

Keywords: *Mammuthus*, Palaeolithic, hunter-gatherers.

The discovery of large accumulations of woolly mammoth remains together with Upper Palaeolithic artefacts has fascinated both researchers and the general public since the 19th century. However, despite many years of scientific research and dispute, our knowledge about this phenomenon, the relationship between mammoths and contemporaneous Upper Palaeolithic hunter-gatherer groups remains incomplete.

Our project focuses on the mammoth bone accumulations found in the West Carpathian forelands and seeks to establish why they formed and their function for hunter-gatherer groups 35,000–25,000 years ago – a period of major environmental change approaching the Last Glacial Maximum. According to various studies carried out over the course of more than 100 years, interpretations for the formation of these assemblages range from human transport of body parts and / or skeletal elements from other locations, to hunter-gatherer use of bones and ivory from carcasses of naturally deceased mammoths. But recently, the hypothesis explaining the formation of the accumulation of mammoth remains as direct consequence of a hunting strategies used by specialized hunter-gatherer groups has gained increasing importance. Therefore, at the present stage of research, both natural and/or anthropogenic agents may account for the creation of the archaeological record, which in addition may have seen recurrent human occupations that eventually produced stratified deposits and / or palimpsests of mixed

assemblages reflecting many different episodes of activities. From this point of view investigations into the formation of mammoth bone accumulations, mammoth extinction, as well as the history of human-mammoth interactions, still generate considerable controversy and disagreement, which our grant aims to explain.

[Talk] [non-student]

“Jurassic Europe”: transferring science with a new interactive media station

Oliver Wings[1,*], Joschua Knüppe[2], Michael Arnold[3] & Christian Bartel[1]

[1] SNSB, Natural History Museum Bamberg, Bamberg, Germany;

[2] Independent researcher, Ibbenbüren, Germany;

[3] in medias res Marktkommunikation GmbH, Nürnberg, Germany;

[*] wings@snsb.de – presenting author

Keywords: Science transfer, museum exhibition, palaeobiogeography, Jurassic, Dinosauria.

Visualization using digital media is becoming increasingly important in the knowledge transfer in natural history museums. Apps that can interactively expand knowledges in a flexible and playful way with a low entry barrier are best suited for this purpose. In our project, a new media station was created that presents the European palaeobiogeography in the Late Jurassic (Kimmeridgian–Tithonian) as a touchscreen kiosk application. The application runs in 4K resolution and is installed on a 55-inch monitor with a capacitive display. It is controlled using touch gestures similar to those used on smartphones.

The kiosk application has the following main features: land-sea distribution from the Jurassic period as well as the present day (scroll and zoom) including geological highlights, switchable political borders and capitals, most important European fossil sites from the Late Jurassic with photographs of the locations and important fossils, and colored reconstructed sketches of most tetrapods (marine reptiles, dinosaurs, pterosaurs, and mammals) known throughout Europe from this period.

By far the most time-consuming part of the project was compiling the scientific background information and graphically creating a palaeogeographic map incorporating the latest research findings, as well as outline drawings for all relevant tetrapods. This work was carried out and kept up to date over several years by palaeoartist Joschua Knüppe. The app was programmed

by the company in medias res, specialized in interactive media. The application is designed to be updateable in order to accommodate future knowledge gains.

The goal of the project is to provide innovative, playful, and easily accessible information about paleogeography and the European tetrapod fauna of the Late Jurassic period. The media station with its interactive touchscreen monitor is intended to appeal particularly to teenagers and young adults – target groups that are otherwise difficult to reach in natural history museums. The reception of the media station is currently studied and measured, i.e., by the frequency of use by museum visitors.

Our interactive station also has the advantage that content can be quickly exchanged, improved, and added, based on new scientific findings. An aspect rarely found in other exhibitions. To complete the displayed information, we still need photographs of many important Late Jurassic fossillagerstätten throughout Europe. If you could contribute to this project by providing such photographs, please contact us.

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[Poster] [student]

The dietary preferences of the titanosaur *Nemegtosaurus mongoliensis* (Dinosauria, Sauropoda)

Marceli Witasik[1,*], Paweł Bącal[2], Krzysztof Stefaniak[1] & Justyna Słowiak[2]

[1] Department of Palaeozoology, Faculty of Biological Sciences, University of Wrocław, Wrocław, Poland;

[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;

[*] marceli.witasik@uwr.edu.pl – presenting author

Keywords: Sauropoda, Titanosauria, palaeoecology, dentition microwear.

Nemegtosaurus mongoliensis Nowiński, 1971, is a titanosaurian sauropod dinosaur from the Late Cretaceous (Maastrichtian) of Mongolia. The holotype, a nearly complete skull ZPAL (Institute of Paleobiology, Polish Academy of Sciences, Warsaw) MgD-I/9, was found in the Nemegt Formation. *Nemegtosaurus* was originally considered to be related to *Diplodocus* due to some convergent morphological features of its skull, such as the general shape of the snout and the narrow-crowned morphotype of its teeth. Subsequent phylogenetic analyses placed *Nemegtosaurus* within Titanosauria – a clade comprising the later-diverging sauropods. Although the phylogenetic position of this dinosaur taxon seems to be resolved, little is still known about its palaeoecology. The narrow-crowned dentition, typical for diplodocoid sauropods, but present also in *Nemegtosaurus*, is associated with a preference for softer vegetation. Herein, the surface of the *Nemegtosaurus* teeth was analysed under the scanning electron microscope (SEM) in order to determine the dental microwear pattern. Preliminary studies show that the dental microwear observed in *Nemegtosaurus* teeth is dominated by very long and narrow mesiodistally oriented scratches, less often pits, similar to teeth of the diplodocoid *Rebbachisaurus*. New data on the dental microwear of *Nemegtosaurus* teeth suggests that this titanosaur shared dietary preferences with some diplodocoids, which can also explain the convergent cranial features present in *Nemegtosaurus* and Diplodocoidea.

Funding: provided by the University of Wrocław and the Institute of Paleobiology PAS.

[Talk] [non-student]

Man and woolly mammoth at the Kraków Spadzista (Poland) – taphonomy of the site

Piotr Wojtal[1,*] & Jarosław Wilczyński[1]

[1] Institute of Systematics and Evolution of Animals, Polish Academy of Sciences, Kraków, Poland;

[*] wojtal@isez.pan.krakow.pl – presenting author

Keywords: *Mammuthus primigenius*, Gravettian, Upper Palaeolithic, hunter-gatherers.

The Kraków Spadzista site, one of the most famous archaeological sites in Eurasia. It was accidentally discovered more than half century ago, in 1967. The excavations at the site were conducted in 21 trenches and test pits from 1968 to the present, with several interruptions. During this period approximately 385 square metres of the site have been explored. The series of radiocarbon dates cluster from 25.0 to 20.0 ka uncal BP, thus placing the site within the Gravettian cultural complex. The site is most renowned for the discovery of a substantial accumulation of mammoth bones in trench B+B1. A significant number of Late Gravettian artefacts were discovered among the mammoth remains. Numerous stone artefacts and faunal remains have also been found in trenches close to this assemblage. By 2017, the site had yielded more than 118,000 bone remains of various Pleistocene steppe-tundra mammals. The majority of the faunal remains, amounting to almost 30,000, have been identified as belonging to the woolly mammoth (*Mammuthus primigenius*), of which at least 113 individuals have been estimated. The second taxon that is well represented in the osteological material of the Kraków Spadzista is the Arctic fox (*Vulpes lagopus*). The remains of at least 35 individuals of this species have been found. The presence of other mammals at the Kraków Spadzista site is indicated by a smaller number of bones and teeth from single individuals. It should be noted that 700 rodent remains were collected during excavations at the site. They were collected by wet sieving the sediments of the Gravettian cultural layers from the 2011–2017 excavations.

Three possible zones of Late Gravettian hunter-gatherer activity have been identified at the Kraków Spadzista site: a camp area, a lithic workshop and an animal (Arctic foxes) processing area, besides the well-known accumulation of mammoth bones. On the basis of the analyses of lithic materials, faunal remains, isotopic and radiometric data, it can be assumed that the site was a frequently reoccupied area by groups of Late Gravettian hunters for periods of a few weeks or months in autumn-winter period. This short-term camp site was related to mammoth hunting and processing. Most of the animals were probably killed and dismembered by the hunters on or near the site. Direct (fragments of flint points embedded in bones) and indirect (artefacts with characteristic impact marks) evidences of mammoth hunting were collected. Cut marks were found on mammoth bones, confirming the dismemberment of killed animals. After the Late Gravettian hunters left, the Kraków Spadzista were visited by wolves. These large carnivores used the remains of mammoths as a food source and gnawed the bones, sometimes very intensely.

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[Talk] [non-student]

An Early Triassic saurosphargid (Reptilia, Sauropterygomorpha) from the Italian Dolomites

Andrzej S. Wolniewicz[1,2,*], Evelyn Kustatscher[3] & Baran Karapunar[4]

[1] Department of Earth Sciences, University of Cambridge, Cambridge, United Kingdom;
[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[3] Tiroler Landesmuseum, Innsbruck, Austria;
[4] School of Earth and Environment, University of Leeds, Leeds, United Kingdom;
[*] asw49@cam.ac.uk – presenting author

Keywords: Saurosphargidae, Sauropterygomorpha, Early Triassic, Italian Dolomites, Permian–Triassic boundary.

Several reptile groups, including Ichthyosauromorpha (ichthyosaurs and their relatives) and Sauropterygomorpha (sauropterygians, saurosphargids, and kin), are thought to have invaded the marine realm in the aftermath of the Permo–Triassic Mass Extinction Event (PTME). This evolutionary transition is generally believed to have occurred in the Early Triassic (Spathian, Olenekian), in the eastern Tethys region (southern China). However, recent fossil discoveries have challenged this view, suggesting that marine invasion may have predated the Triassic, at least in the case of ichthyosauromorphs, and casting doubt on the eastern Tethyan origin of marine reptiles. Saurosphargidae - a small clade of armoured marine reptiles closely related to, or even nested within, Sauropterygia - are particularly important for addressing questions about the timing and geographic origin of Sauropterygomorpha. Until recently, the stratigraphically earliest saurosphargid was known from the Lower Triassic (Spathian, Olenekian) of South China, supporting the hypothesis of an eastern Tethyan origin of the group following the PTME. Here, we report a new saurosphargid specimen from the Lower Triassic (Spathian, Olenekian) of the Italian Dolomites. The specimen displays a combination of morphological character states found in *Sinosaurosphargis* and *Largocephalosaurus* from the Middle Triassic of southern China but differs in possessing a proportionally tall neural spine - suggesting it likely

represents a distinct taxon. This new specimen is one of only two unambiguous Early Triassic occurrences of Saurosphargidae known to date and indicates that saurosphargids were already geographically widespread along Tethyan coastlines during the Early Triassic. The discovery implies either a very rapid dispersal of saurosphargids across the Tethyan region shortly after their origin in the Early Triassic, or an origin in the latest Permian followed by broad geographic expansion by the Early Triassic. New reptile fossils spanning the Permo–Triassic boundary, alongside a more robust understanding of the phylogenetic interrelationships among Sauropterygomorpha, are essential for testing these competing hypotheses on the timing and geographic origin of sauropterygomorphs.

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[Poster] [student]

First palaeoneurological studies of the Polish aetosaur *Stagonolepis olenkae* (Aetosauria, Stagonolepididae) from the Upper Triassic Grabowa Formation, Poland

Juana Yañez-Seoane[1,*], Tomasz Sulej[2], Mateusz Tałanda[3], M. Belén von Baczko[4,5] & Julia B. Desojo[1,5]

[1] División Paleontología Vertebrados, Facultad de Ciencias Naturales y Museo, Universidad Nacional de la Plata, La Plata, Argentina;
[2] Institute of Paleobiology, Polish Academy of Sciences, Warsaw, Poland;
[3] Institute of Evolutionary Biology, Faculty of Biology, Biological and Chemical Research Centre, University of Warsaw, Poland;
[4] Sección Paleontología de Vertebrados, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", Ciudad Autónoma de Buenos Aires, Argentina;
[5] Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Ciudad Autónoma de Buenos Aires, Argentina;
[*] jyanez@fcnym.unlp.edu.ar – presenting author

Keywords: endocast, Carnian, Keuper, inner ear, cranial nerves.

Aetosauria represents a diverse clade of terrestrial armored crocodile-line archosaurs restricted to the Late Triassic and were nearly cosmopolitan in distribution. One of the best-known taxa in Poland is *Stagonolepis olenkae*, from the Grabowa Formation of Late Triassic (Carnian) in Krasiejów. We studied the skull material of three specimens of *Stagonolepis olenkae* recovered from the same locality and age deposits: the holotype, ZPAL Ab III/466 17, and two new individuals, ZPAL Ab III/4402 and ZPAL Ab III/4403, housed at the Institute of Paleobiology, Polish Academy of Sciences, Warsaw. Three new cranial endocasts of *Stagonolepis olenkae* are obtained through CT scan images, representing their encephalon, cranial nerves, inner ear, and endocranial vasculature. In these new models, it is observable that brain hemispheres are differentiable from the rest of the endocast and the width of the encephalon is about a third of

its total length. The flocculus is small, similar to *Desmatosuchus* and the hypophysis is well developed and conspicuous, contrary as previously interpreted.

Cranial nerves CN II-CN XII are clearly recognized, as well as the anterior semicircular canals and partial portions of posterior and lateral canals. Lagena and fenestra ovalis are noticeable in both materials. It seems to be an assymetry between the anterior and posterior semicircular canals on the inner-ear, being the anterior one the most prominent.

The previously interpreted foramen for CN III is recognized as a shared opening containing the CN III passages in its most dorsal borders and the hypophyseal fossa in its ventral portion. The laterosphenoid is smaller than previously interpreted in *Stagonolepis olenkae* and the ossified orbitosphenoid is located anterior to it, as observed only in the aetosaur *Desmatosuchus* and other pseudosuchians like *Tarjadia* and *Prestosuchus*, but contrary to living crocodilians in which the orbitosphenoid remains cartilaginous even in adult forms (*Caiman*, *Alligator*). The novel endocasts will be further analyzed in search of intraspecific variability and the sensorial and locomotor capabilities of the species and compared to other aetosaurs from the slender (*Neoaetosauroides*, *Aetosauroides*) and robust (*Desmatosuchus*, *Typothorax*) morphotype groups.

[Poster] [student]

New occurrences of Plagiosauridae (Temnospondyli) show a more complex pattern of decline for this group

Jakub Zalewski[1,*]

[1] Institute of Evolutionary Biology, Faculty of Biology, University of Warsaw, Poland;
[*] j.zalewski13@student.uw.edu.pl – presenting author

Keywords: Plagiosauridae, osteology, Poland, Late Triassic, palaeobiogeography.

Temnospondyli are morphologically diverse and taxonomically numerous amphibians. In the Triassic they represented important elements of tetrapod faunas, due to their global distribution, until the Late Triassic when their taxonomic diversity and number of occurrences declined. Plagiosauridae is a Triassic family characterised by distinct brachycephalic and parabolic skulls that follows this pattern of changes in biodiversity. The family appeared in thw Early Triassic and from the Middle Triassic all three subfamilies are known: Plagiosaurinae, Plagiosterninae and Plagiosuchinae. After the Carnian only one subfamily is known - Plagiosaurinae. It is represented by two genera: the well studied *Gerrothorax pulcherrimus* with broad stratigraphic and geographic range, and *Plagiosaurus depressus* known from a single locality in Halberstadt (Germany). In contrast to numerous finds from Western and Northern Europe, the Polish Late Triassic plagiosaurid material has received little attention and its osteology or taxonomy has not been documented in detail. New occurrences from multiple Silesian localities offer new insights into the biogeography and taxonomic diversity of this group. Postcranial elements in the Silesian material show characteristics of both genera *Gerrothorax* and *Plagiosaurus* across different specimens. The expanded biogeographic range of *Plagiosaurus* and the presence of at least two genera in the Polish material may suggest that Plagiosaurinae maintained a certain degree of diversity shortly before their extinction in the Rhaetian.

[Talk] [student]

Reconstruction of the three-dimensional dental vascular system of Synechodontiformes (Neoselachii) from the Late Permian to the Middle Triassic of China, with remarks on the pseudopolyaulacorhize vascularization

Siyan Zhao[1,*], Jiachun Li[2] & Zuoyu Sun[1]

[1] School of Earth and Space Sciences, Peking University, Beijing, China;

[2] School of Earth Sciences and Engineering, Xi'an Shiyou University, Xi'an, China;

[*] 2301210132@pku.edu.cn – presenting author

Keywords: Sharks, Synechodontiformes, histology, vascular, micro-CT.

The Synechodontiformes, with fossil records spanning from the Early Permian to the Paleogene, represent the earliest confirmed Neoselachii sharks and are considered the sister group to extant sharks. Synechodontiform sharks exhibit unique pseudopolyaulacorhize vascularization, characterized by a series of unroofed canals situated in the labial depression of the basal root face. This feature is particularly significant for taxonomy, especially considering that most Synechodontiform sharks are represented solely by tooth fossils. Since the root of some Hexanchiformes also exhibit unroofed canals on the labial basal face (without a depression), this suggests that the trait could have arisen through convergence. Therefore, understanding how these unroofed canals are associated with the internal vascular canals is particularly important. Here, the dental histology, including three-dimensional vascular systems, of five Synechodontiformes taxa from the Late Permian to the Middle Triassic of China, is examined using high-resolution micro-CT to provide a comprehensive understanding of the pseudopolyaulacorhize vascularization and to offer histological data that may help resolve the uncertain interrelationships within this group. The results show that all five taxa studied exhibit orthodont histotype, perhaps representing the plesiomorphic condition of

Neoselachii sharks. The vascular systems of these Synechodontiformes exhibit a striking degree of consistency, comprising longitudinal vascular canal(s), labial transverse vascular canals, lingual transverse vascular canals, and an ascending pulp cavity. The labial transverse vascular canals extend obliquely toward the basal face of the tooth, where they become unroofed canals. Additionally, some microborings have also been identified, and in certain teeth, they may account for up to 37% of the tooth's volume, implying that a significant amount of phosphate may have been returned to the ocean, considering the large number of shark teeth present in the stratum.

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