11th EAVP Meeting – Villers-sur-Mer France

11th – 15 th June 2013

PALEOSPACE
L'ODYSSÉE

« Accéder à la science, c'est, spirituellement rajeunir ; c'est accepter une mutation brusque qui doit contredire un passé. » Gaston Bachelard, 1938.

Avec la création du Paléospace, *Musée de France*, il y a deux ans, la ville de Villers-sur-Mer en partenariat avec la Communauté de Communes Cœur Côte Fleurie concrétisait un projet qui lui tenait à cœur depuis plus de 18 ans et qui était sous-jacent depuis le 20e siècle, avec la sauvegarde et la conservation de collections locales et privées de paléontologie. Collectionneurs, amateurs de fossiles puis scientifiques, ont enrichi ce fonds grâce à leurs dons et leurs connaissances et ce, avec le même objectif : comprendre…

La construction d'un musée n'est pas une finalité en soi. La vocation du Paléospace est d'une part de faire vivre les collections, les porter à la connaissance du plus grand nombre par le biais des expositions permanentes et temporaires, d'actions d'éducation, de l'ouverture des réserves, de la diffusion culturelle et scientifique et d'autre part d'apporter nos compétences et notre soutien aux progrès des connaissances et de la recherche. C'est pourquoi nous nous réjouissons d'offrir ce moment privilégié pour le propos scientifique et d'accueillir le 11e congrès de *l'European Association of Vertebrate Palaeontologists*, permettant de mettre en lumière les travaux des paléontologues.

Nous espérons que le cadre de Villers-sur-Mer sera idéal pour ce congrès, que nous souhaitons convivial et riche en échanges. Nous pourrons alors nous féliciter d'avoir contribué à notre mesure, aux efforts de la recherche scientifique.

Bienvenue à Villers-sur-Mer, nous vous souhaitons un excellent congrès !

Gérard Vauclin,

Maire de Villers-sur-Mer, Président du Paléospace

Cover drawing: Michel Fontaine

Pictures from Gregory Wait

European Association of Vertebrate Palaeontologists 11th Annual Meeting Villers-sur-Mer, France 11th-15th of June, 2013

organized by Laurent Picot

for

Paléospace l'Odyssée

Table of Contents

1- Paléospace l'Odyssée, avenue Jean Moulin 14640 Villers-sur-Mer
2- Cinema & Casino, Place du Lieutenant Fernand Fanneau 14640 Villers-sur-Mer
3- Tourist information office, Place Jean Mermoz 14640 Villers-sur-Mer
4- Le Villare, 26 Rue du Général de Gaulle 14640 Villers-sur-Mer
5- La Celloise, rue Poincaré 14640 Villers-sur-Mer

11th EAVP Meeting Program – Villers-sur-Mer (France)
11th – 15th of June 2013

Tuesday 11th of June

From 14:00 to 18:00: **Registration** at the Paléospace-l'Odyssée (incl. payment)
Free visit of the Muséum during the whole Meeting with your badge.

18:30 : **Icebreaker party**
Welcome address from Mr Gérard Vauclin, mayor of the town, Karine Boutillier, director of the Paléospace, Christian Meyer, president of the EAVP and Eric Buffetaut.

Wednesday 12th of June

9:00 : Arrival of the conference participants at the Cinéma of the town. Placing of the posters in the panoramic room of the Casino (near the Cinema).

9:15-9:30 : Welcome address by Christian Meyer

Chaiman: Jeff Liston

9:30-9:50 : **Evolutionary trends and integration patterns in the conodont genus *Polygnathus*.**
Soledad De Esteban- Trivigno & Carlos Martínez-Perez (p.32).

9:50-10:10 : **The continental bony fish assemblage from the Cenomanian (Late Cretaceous) of the Ifezouane Formation, SE Morocco**
Lionel Cavin, Larbi Boudad, Emilie Läng, Jérôme Tabouelle & Haiyan Tong (p.22)

10:10-10:30 : **Associated skeletal and dental remains of a fossil odontaspidid shark from the Middle Eocene of Denmark**
Gilles Cuny, Bitten Bolvig Hansen, Bo Wilhelm Rasmussen, Kenshu Shimada, Perri Jacobs & Claus Heilmann-Clausen (p.30)

10:30 **Coffee Break**

Chairman: Lionel Cavin

11:00-11:20 : **The billfish *Palaeorhynchus* (Xiphioidei, Palaeorhynchidae) from the Menilitic formation (Oligocene, Sitborice member) at the Litenčice locality (Czech Republic).**
Růžena Gregorová & Jeff Liston (p.39)

11:20-11:40 : **The actinopterygian fauna from the Miocene of Jabal Zaltan, Libya**
Thodoris Argyriou, Alison M. Murray, Olga Otero & Aurélie Pinton (p.16)
Raymonde Rivoallan Award

11:40-12:00 : **A year in lissamphibian origins**
David Marjanović (p.50)

12:00-14:00 **Lunch Break**

Chairman: Gilles Cuny

14:00-14:20 : **Bone microstructure provides new evidence for terrestrial lifestyle adaptations for the Lower Triassic stereospondyl *Lydekkerina* (Tetrapoda: Temnospondyli)**
Aurore Canoville & Anusuya Chinsamy (p.21) **Transmitting Science Award**

14:20-14:40: **Review of the latest Cretaceous Albanerpetontidae from Haţeg Basin (Romania)**
Zoltán Csiki-Sava,Márton Venczel & Ştefan Vasile (p.29)

14:40-15:00 : **Tupilakosaurid amphibians (Temnospondyli) and interrelationships of the Trimerorhachomorpha**
Mikhail A. Shishkin (p.62)

15:00-15:20 : **New insights into the sinus systems of nonmammalian synapsids with the help of neutron tomography**
Michael Laaß, Eberhard Frey, Anders Kaestner & Peter Vontobel (p.44)

15:20 Coffee Break

Chairwoman: Haiyan Tong

15:50-16:10 : **Ecology and niche partitioning in mosasaurid faunas from the Maastrichtian Phosphates of Morocco**
Nathalie Bardet, Alexandra Houssaye, Peggy Vincent, Xabier Pereda Suberbiola & Mbarek Amaghzaz (p.17)

16:10-16:30: **Plesiosaur specimens from the Maastrichtian Phosphates of Morocco**
Peggy Vincent, Nathalie Bardet, Alexandra Houssaye, Xabier Pereda Suberbiola & Mbarek Amaghzaz (p.67)

16:30-16:50 :**Histology of pterosaur mandibular symphyses from Hungary: An ontogenetic series?**
Edina Prondvai, Emese R. Bodor & Attila Ősi (p.59)

16:50-17:10: **Flying dragons and hunting sea monsters – animated 3D models for scientific studies and museum films**
Michael Laaß, Corinna Hoff & Eberhard Frey (p.45)

17:15 : **General Assembly of the European Association of Vertebrate Paleontologists**

Auctions

20:00 **Tour of the Town**
Departing from the front of the Tourist Information office

Thursday 13th of June

Chairman: Christian Meyer

9:00-9:20 : **Lindholmemydid turtles (Cryptodira: Testudinoidea) from the Late Cretaceous of Shadong Province, China**
Lu Li, Haiyan Tong, Kebai Wang, Shuqing Chen & Xing Xu (p.47)

9:20-9:40 : **First steps to the underground world: the Cretaceous lizard *Slavoia*.**
Mateusz Tałanda & Marcin Bińkowski (p.65)

9:40-10:00 : **A nearly complete *Varanus* skeleton from the late Miocene of Cerro de los Batallones (Madrid Basin)**
Massimo Delfino, Juan Abella, Israel M. Sánchez & David M. Alba (p.33)

10:00-10:20 : **The evolution of sauropodomorph long bone histology revisited: Long bone histology of a "prosauropod" (Dinosauria: Sauropodomorpha) from the Late Triassic of Normandy and a comparison with some large bone shafts from the Late Triassic Aust Cliff near Bristol (England).**
Koen Stein, Eric Buffetaut & Martin P. Sander (p.63)

10:20 **Coffee Break**

Chairman: Koen Stein

10:50-11:10 : **'Mudstone Red in Tooth and Paw':New finds from the basement of the Jurassic**
Jeff Liston, Liu Jian-Rong, Tom Challands, Heinrich Mallison, Darren Naish, Christian Meyer & Feng Zhou (p.48)

11:10-11:30 : **A partial skull of *Hungarosaurus* from the Late Cretaceous of Hungary: implications for ankylosaur locomotion**
Attila Ősi, Xabier Pereda Suberbiola &Tamás Földes (p.55)

11:30-11:50 : **Early Cretaceous dinosaur remains from Dobrogea (southeastern Romania)**
Zoltán Csiki-Sava, Vlad Codrea & Ştefan Vasile (p.28)

11:50-12:10 **Palaeohistology reveals the maturity of the *Turiasaurus riodevensis* holotype**
Francisco Gascó, Rafael Royo-Torres, Alberto Cobos & Luis Alcalá (p.38)

12:10-14:00 **Lunch Break**

Chairman: Loïc Costeur

14:00-14:20 : **A reassessment of the first Late Jurassic megatracksite in Northern Switzerland**
Christian A. Meyer, Basil Thüring & Daniel Marty (p.52)

14:20-14:40 : **Morganucodonta from Saint-Nicolas-de-Port (Upper Triassic, France): origin of mammiliaformes and T/J crisis**
Maxime Debuysschere (p.31)

14:40-15:00 : **Finite element analysis of the cingulate lower jaw**
Sílvia Serrano-Fochs, Soledad De Esteban-Trivigno, Jordi Marcé-Nogué, Josep Fortuny & Richard Fariña (p.61)

15:00-15:20 : **New discoveries of rodents from the Oligocene and Miocene of the Valley of Lakes (Central Mongolia): biostratigraphic and biogeographic implications**
Olivier Maridet, Gudrun Daxner-Höck, Demchig Badamgarav & Ursula B. Göhlich (p.49)

15:20 **Coffee Break**

Chairman: Olivier Maridet

16:00-16:20 : **Evolutionary history of hoofed mammals during the Oligocene-Miocene transition in Western Europe**
Laureline Scherler, Bastien Mennecart, Florent Hiard, Damien Becker & Jean-Pierre Berger† (p.60)

16:20-16:40 : **Ungulate diets through the Cenozoic of Europe inferred from dental mesowear: report on the first steps of the analysis**
Loïc Costeur, Laure Bapst, Florent Hiard & Damien Becker (p.27)

16:40 -17:00: **The giant Pleistocene camel from El Kowm, Syria**
Pietro Martini, Loïc Costeur, Jean-Marie Le Tensorer & Peter Schmid (p.51)

17:00-17:20: **Evolution of Hominoids' ecological niche during the Miocene**
Noémie Hamon, William E. Banks, Pierre Sepulchre, Jean-Jacques Jaeger & Gilles Ramstein (p.40)

17:20 : **Poster session**

19h30 : **Conference dinner** in the panoramic room of the Casino (near the Cinema).

Friday 14th of June

SAPE session on fossil birds
Organizers: Eric Buffetaut & Nikita Zelenkov

Chairwoman: Anusuya Chinsamy

9:00-9:20: **Rates of dinosaur limb evolution provide evidence for exceptional radiation in Mesozoic birds**
Roger B. J. Benson & Jonah N. Choiniere (p.19)

9:20-9:40 :**A new robust enantiornithine bird from the Lower Cretaceous of China with scansorial adaptations**
Min Wang, Jingmai K.O'Connor & Zhonghe Zhou (p.69)

9:40-10:00 :**A three-dimensionally preserved basal ornithuromorph from the Jehol Biota with long fan-shaped tail feathers and food remains**
Shuang Zhou, Zhonghe Zhou & Jingmai O'Connor (p.72)

10:00-10:20 :**Following in the footsteps of dinosaurs: ancient avian feeding behaviour from the Haman Formation of South Korea.**
Amanda R. Falk, Jong-Deock Lim, Larry D. Martin & Stephen T. Hasiotis (p.37)

10:20 **Coffee Break**

Chairman: Nikita Zelenkov

10:50-11:10 :**Tail evolution in early birds: soft tissue and skeletal evidence from the Jehol**
Jingmai K. O'Connor (p.54)

11:10-11:30 : **New information on *Pengornis* from a subadult specimen**
Han Hu, Zhou Zhong-He & Jingmai K. O'Connor (p.42)

11:30-11:50 : **Palaeobiological deductions from the bone histology of the Early Cretaceous bird *Confuciusornis sanctus.***
Anusuya Chinsamy, Luis M. Chiappe & Jesús Marugán-Lbobón (p.25)

11:50-12:10 **New remains of the giant bird *Gargantuavis* from the Late Cretaceous of Provence (south-eastern France)**
Eric Buffetaut, Patrick Mechin, Annie Mechin-Salessy & Delphine Angst (p.20)

12:10-14:00 **Lunch Break**

Chairman: Attila Ösi

14:00-14:20 : **Insight into the growth dynamics of the Late Cretaceous bird *Gargantuavis* from bone histology.**
Anusuya Chinsamy, Eric Buffetaut, Aurore Canoville & Delphine Angst (p.24)

14:20-14:40 : **A new bird from the latest Maastrichtian of North America**
Robert A. DePalma, David A. Burnham, Larry D. Martin & Amanda R. Falk (p.34)

14:40-15:00 : **New data about eggshells of giant birds from the Early Tertiary of southern France**
Delphine Angst, Eric Buffetaut, Christophe Lécuyer, Romain Amiot, Annie Méchin, Patrick Méchin, Stephen Giner, André Amoros, Franck Smektala, Lucien Leroy, Myette Guiomar & Haiyan Tong (p.15) **Raymonde Rivoallan Award**

15:00-15:20 : **The northern-most fauna of fossil birds in Asia: Miocene birds from Baikal Lake (Siberia)**
Nikita V. Zelenkov & Nikolay V. Martynovich (p.70)

15:20-15:40: **Extinction**
Ella Hoch (p.41)

15:40 : **Closing session**
16:30 : **Reception** at the Villare and Visit to the Palaeontological Association of Villers-sur-Mer

18:30 **Public Conference** at the Cinema : «Dinosaures espagnols» by Xabier Pereda Suberbiola

Saturday 15th of June

8:30 : **Fieldtrip** to the cliffs of the «Vaches Noires»
With Nathalie Bardet & Laurent Picot
Departing from the front of the Tourist information office

15:00 :**Visit to the Paleospace storeroom**

18:30 **Public Conference** at the Cinema «Quand les poissons-baleines et les coelacanthes fréquentaient la Normandie» by Lionel Cavin

Abstracts

Coal's cool bones: a new assemblage of dinosaurs and other vertebrates from the Lower A1bien Escucha formation in Ariño (Parque cultural del Río Martín, Teruel, Spain)

Luis Alcalá [(1)], Eduardo Espílez [(1)], Luis Mampel [(1)], Ana González [(1)], Diego Rubio [(2)], James I. Kirkland [(3)], Andrew T. McDonald [(4)], Ángela D. Buscalioni [(5)], Daniel Ayala [(1)], Alberto Cobos [(1)], Rafael Royo-Torres [(1)], Francisco Gascó [(1)], Mª Dolores Pesquero [(1)]

[(1)] Fundación Conjunto Paleontológico de Teruel-Dinópolis (Museo Aragonés de Paleontología). Avda. Sagunto s/n, 44002 Teruel (Spain). alcala@dinopolis.com
[(2)] Sociedad Anónima Minera Catalano-Aragonesa (SAMCA). Carretera, 18, 44547 Ariño (Teruel, Spain). drubio@samca.com
[(3)] Utah Geological Survey, 1594 West North Temple, Suite 3110, P.O. Box 146100, Salt Lake City, UT 84114-6100 (USA). jameskirkland@utah.gov
[(4)] Department of Earth and Environmental Science, University of Pennsylvania, Philadelphia, Pennsylvania (USA). mcandr@sas.upenn.edu
[(5)] Dep. Biología, Paleontología. Universidad Autónoma de Madrid. Cantoblanco, 28049 Madrid (Spain). angela.delgado@uam.es

Systematic palaeontological investigations pursued since 2010 in the Escucha Formation (late Aptian-Albian) near Ariño (Teruel, Spain), in the open-pit lignite mine Santa María (SAMCA Group), have revealed a vast fossiliferous horizon that contains numerous remains of dinosaurs and other Mesozoic vertebrates.

As of March 2013, 101 concentrations with 5,269 fossil bones have been mapped, after prospecting a 250,000 m^2 area of the stratigraphic layer where fossils are preserved. This layer is just below the last coal level mined, and thus has been exposed following coal extraction.

Six partial skeletons of a new iguanodontian, *Proa valdearinnoensis*, have been recovered. Theropods are represented by a number of isolated teeth similar to those of Allosauroidea. Thyreophorans, goniopholidids, turtles, and chondrichthyan and osteichthyan fishes have also been recorded, as well as plants and invertebrates (amber, pollen, charophyte oogonia, bivalves, gastropods, and ostracods). Abundant coprolites preserve angiosperm pollen grains, fern spores, and fossil bacteria forms.

The Lower Cretaceous vertebrate assemblage at Ariño, will allow us to document the European continental Albian fossil record. It also represents a new scientific resource used to promote local cultural park facilities and landscapes (Parque Cultural del Río Martín), in a rural region whose economy is seriously affected by current and future financial instability related to the production of energy in the European Union via coal power plants.

Acknowledgments**:** SAMCA Group; Departamento Educación, Universidad, Cultura y Deporte, Gobierno de Aragón (projects 201-2010, 201/10-2011, 201/10-11-2012, 201/10-2013); Fundación Conjunto Paleontológico de Teruel-Dinópolis; Fundación SAMCA; FOCONTUR (Grupo de Investigación Consolidado E-62, Departamento de Industria e Innovación, Gobierno de Aragón and Fondo Social Europeo); Ministerio de Ciencia e Innovación/FEDER (project DINOSARAGÓN CGL2009–07792); Ministerio de Educación y Ciencia (AP2008-00846); and Instituto Aragonés de Fomento.

New data about eggshells of giant birds from the Early Tertiary of southern France

Delphine Angst [1*], Eric Buffetaut[2], Christophe Lécuyer[1], Romain Amiot[1], Annie Méchin [3], Patrick Méchin [3], Stephen Giner [4], André Amoros[5], Franck Smektala [6], Lucien Leroy [7], Myette Guiomar [8] & Haiyan Tong [9]

[1] : CNRS, UMR 5276, Laboratoire de Géologie de Lyon, Villeurbanne, France. * angst.delphine@gmail.com
[2] : CNRS, UMR 8538, Laboratoire de Géologie de l'Ecole Normale Supérieure, Paris, France
[3] : Vitrolles 13127, France
[4] : Muséum d'histoire naturelle de Toulon et du Var, Toulon, France
[5]: Pourcieux 83470, France
[6]: GEORS, diamoco company, France
[7]: Taloire 04120, Castellane, France
[8]: Réserve Naturelle de Haute Provence, BP 156, 04005 Digne-les-Bains cedex, France
[9]: Palaeontological Research and Education Centre, Maha Sarakham University, Thailand

Fragments of large bird eggs were first reported from Early Tertiary continental deposits in southern France by Dughi and Sirugue (1959). Since then, both their stratigraphic distribution and their systematic assignment have been hotly debated. On the basis of renewed field work in Provence (Bouches-du-Rhône and Var), the following conclusions can be reached:

- only two eggshell types can be distinguished, as already noted by Touraine (1960): a thin-shelled type, corresponding to the oospecies *Ornitholithus biroi* Dughi & Sirugue, 1962, and a thick-shelled type corresponding to Dughi and Sirugue's *Ornitholithus arcuatus* group. The four oospecies distinguished by Dughi and Sirugue (1962) within the *O. arcuatus* group cannot be distinguished on the basis of shell microstructure and differences in ornamentation are probably due to individual variation and different states of preservation.
- the thin-shelled and thick-shelled types never occur together. On the basis of the stratigraphic framework for the Aix basin of Cojan *et al.* (2000), the thin eggshells occur in Thanetian red marls underlying the Calcaire de Saint-Marc Formation, whereas the thick eggshells are found in the upper part of the Calcaire de Saint-Marc Formation and in overlying red marls, and are Sparnacian in age.
- because no skeletal remains have ever been found in the eggshell-bearing formations, it is difficult to refer these eggs to a specific group of birds. However, their stratigraphic distribution mirrors that of giant birds of the family Gastornithidae in Europe and they may have been laid by gastornithids, as already suggested by several authors.

The actinopterygian fauna from the Miocene of Jabal Zaltan, Libya

Thodoris Argyriou[1], Alison M. Murray[1], Olga Otero[2], and Aurélie Pinton[2]

[1]Department of Biological Sciences, University of Alberta, Edmonton, AB, Canada
[2]Institut International de Paléoprimatologie, Paléontologie Humaine: Evolution et Paléoenvironnements—CNRS UMR 6046, Faculté des Sciences Fondamentales et Appliquées, Université de Poitiers, 40 av. du Recteur Pineau, F-86 022 Poitiers cedex, France

The early to middle Miocene fossil beds of the Maradah Formation exposed in Jabal Zaltan, Libya have been known since the 1930s, but their fossil fish content still remains understudied. Earlier reports of fish fossils include a variety of chondrichthyan taxa and very few actinopterygians some of which were dubiously attributed to extinct genera (e.g., *Saurocephalus*). A recent scientific expedition carried out, in 2010, by the East Libya Neogene Research Project (ELNRP) in Jabal Zaltan brought to light a plethora of vertebrate fossils including both chondrichthyan and actinopterygian remains. Although the examined bony fish material is very fragmentary, we recognized the following twelve taxa, eleven of which were previously unreported: *Polypterus* sp. (Polypteridae); *Hydrocynus* sp. (Alestidae); *Bagrus* sp. (Bagridae); *Auchenoglanis* sp. and *Chrysichthys* or *Clarotes* sp. (both Claroteidae); *Clarias* or *Heterobranchus* sp. (Clariidae); cf. Mochokidae; Siluriformes indet.; *Lates* sp. (Latidae); cf. *Semlikiichthy*s sp. (insertae sedis) and two unidentified perciforms. The composition of the ichthyofauna and its association with other vertebrate fossils (e.g., warm water elasmobranchs, crocodylians, turtles, sirenians, proboscideans, rhinos, suids, giraffids, etc.) corresponds to a tropical - subtropical climate and a mosaic of paleoenvironments that include gallery forest, savannah, rivers and estuaries. More specifically, the recovery of *Hydrocynus* and large *Lates* elements from the area are indicative of open and deeper freshwater conditions and suggest the presence of a large river. On the other hand, facultative air breathers like polypterids and clariids can withstand (or require for reproduction in the case of polypterids) less oxygenated environments indicating that shallower and more stagnant waters (e.g., vegetated swamps) could be found in the vicinity.

Ecology and niche partitioning in mosasaurid faunas from the Maastrichtian Phosphates of Morocco

Nathalie Bardet[1], Alexandra Houssaye [2], Peggy Vincent [3], Xabier Pereda Suberbiola [4] & Mbarek Amaghzaz [5]

[1] CNRS (UMR 7207), Département Histoire de la Terre, Muséum National d'Histoire Naturelle, Paris, France
[2] Steinmann Institut für Geologie, Paläontologie und Mineralogie, Universität Bonn, Allemagne
[3] Staatliches Museum für Naturkunde, Stuttgart, Allemagne
[4] Departamento Estratigrafía y Paleontología, Facultad de Ciencia y Tecnología, Universidad del País Vasco/ Euskal Herriko Unibertsitatea (UPV/EHU), Bilbao, Espagne
[5] Office Chérifien des Phosphates, Centre minier de Khouribga, Maroc

The Maastrichtian-Ypresian (70.6 – 46.6 Ma) Phosphates of Morocco are known worldwide for their richness in vertebrate fossil remains (e.g. Arambourg, 1952; Bardet et al., 2010). Among these vertebrates, currently represented by about 330 species, 96% are of marine origin and consist of selachians, bony fishes and marines reptiles. The latter are mainly represented by squamates, plesiosaurians, crocodyliformes, chelonians, and birds.

Squamates essentially consist of mosasaurids, which are very abundant and well diversified along the Maastrichtian series, being represented by at least 11 species and 7 genera. Noteworthy is the predominance here – as in several contemporaneous outcrops worldwide – of Mosasaurinae (*Mosasaurus*, *Prognathodon*, *Eremiasaurus*, *Globidens*, *Carinodens*) while Halisauromorphes (*Halisaurus*) remains scarce. Russellosaurina remain also scarce (Plioplatecarpinae: "*Platecarpus*" *ptychodon*) or are apparently absent (Tylosaurinae).

All these mosasaurid taxa exhibit specific tooth morphologies. Placing them in predator guilds - such as those defined by Massare (1987) - enables us to indicate adaptation for piercing, crushing or cutting and thus their prey preferences. The combination of this information with data referring to the gross morphology and to the degree of adaptation to a marine life permits to reveal niche partitioning not only between these mosasaurid faunas, but also with the coeval marine reptiles and selachians leaving in this epicontinental sea.

References:

Arambourg C. (1952). Les vertébrés fossiles des gisements de phosphates (Maroc-Algérie-Tunisie). *Notes et Mémoires du Service Géologique du Maroc*, **92**, 1-372.

Bardet N., Pereda Suberbiola X., Jouve S., Bourdon E., Vincent P., Houssaye A., Rage J.-C., Jalil N. E., Bouya B. & Amaghzaz M. (2010). Reptilian assemblages from the latest Cretaceous - Palaeogene phosphates of Morocco: from Arambourg to present time. *Historical Biology*, **22** (1-3), 186-199.

Massare J.A. (1987). Tooth Morphology and Prey Preference of Mesozoic Marine Reptiles. Journal of Vertebrate Paleontology, **7** (2), 121-137.

An armoured placodont from the Rhaetian (Late Triassic) of Provence (south-eastern France)

Nathalie Bardet[1], Eric Buffetaut[2], Stephen Giner[3] & Daniel Roggero[4]

[1] CNRS (UMR 7207), Département Histoire de la Terre, Muséum National d'Histoire Naturelle, Paris, France
[2] CNRS (UMR 8538), Laboratoire de Géologie de l'Ecole Normale Supérieure, Paris, France
[3] Muséum d'histoire naturelle de Toulon et du Var, Toulon, France
[4] 25 Avenue Delattre de Tassigny, 13127 Vitrolles, France

Although a few placodont remains have already been reported from the marine Rhaetian of Alpes-Maritimes (south-eastern France) (Villoutreys, 1958; Bardet & Cuny, 1993; Bardet et al., 1998), they have not been described in any detail and the record of this group in the Late Triassic of southern France remains very scanty. We report new placodont material from grey limestones of early Rhaetian age which are exposed in a quarry near the village of Le Thoronet, in the central part of department Var (Provence, south-eastern France). The locality has also yielded remains of ichthyosaurs and hybodont sharks. The placodont material consists of at least four isolated crushing teeth, with an oval outline and a depressed central area, often showing a wear facet. The larger teeth are from the posterior part of the jaw, while a smaller one probably was located more anteriorly. These teeth are strongly reminiscent of those of *Psephoderma*, a cyamodontoid placodont genus which is known from the Rhaetian of the northern and southern Alps and possibly England. A small polygonal dermal plate, with a concave inner surface and a sculptured outer surface, is similar to elements of the bony armour of *Psephoderma*. The new material is therefore referred to *Psephoderma* sp. It extends the geographical distribution of the genus to Provence and shows that the Rhaetian of Var is a potentially interesting source of fossil marine reptiles.

References:

Villoutreys, O. de (1958). Sur la faune du Trias des Alpes-Maritimes. *Comptes Rendus sommaires des séances de la Société géologique de France*, 13, 312-313.

Bardet, N. & Cuny, G. (1993). Triassic reptile faunas from France. *Paleontologia Lombarda*, N.S., 2, 9-17.

Bardet, N., Cuny, G., Lachkar, G., Pereda Suberbiola, X.., Mazin, J.M., Thomel, G., Barbieri, L., Vasse, D., Parot, B. & Emily, A. (1998). A new marine vertebrate fauna from the uppermost Triassic of Eastern Provence (France). *Third European Workshop on Vertebrate Palaeontology*, Maastricht, p. 12.

Rates of dinosaur limb evolution provide evidence for exceptional radiation in Mesozoic birds

Roger B. J. Benson, & Jonah N. Choiniere

Department of Earth Sciences, University of Oxford, South Parks Road, Oxford OX1 3AN, United Kingdom
roger.benson@earth.ox.ac.uk

Birds are the most diverse living tetrapod group and are a model of large-scale adaptive radiation, providing key data on the origins of extant vertebrate diversity. Neontological studies suggest a radiation within the avian crown group, long after the origin of flight. However, deep time patterns of bird evolution remain obscure because only limited fossil data have been considered. We analyse cladogenesis and limb evolution on the entire tree of Mesozoic theropod dinosaurs, documenting the dinosaur–bird transition and immediate origins of powered flight. Surprisingly, Mesozoic birds inherited constraints on forelimb evolution from non-flying dinosaur ancestors, and species diversification rates did not accelerate in the earliest flying taxa. However, Early Cretaceous short-tailed birds exhibit both phenotypic release of the hindlimb and increased diversification rates, unparalleled at any other time in the first 155 million years of theropod evolution. Thus, a Mesozoic adaptive radiation of stem group birds was enabled by restructuring of the terrestrial locomotor module, which may therefore represent a key innovation. Our results suggest two phases of radiation in Avialae, with the Cretaceous diversification overwritten by extinctions of stem-group birds at the Cretaceous–Palaeogene boundary and subsequent re-diversification of the crown group. We emphasise the importance of palaeontological data to understanding the origins of modern biodiversity

New remains of the giant bird *Gargantuavis* from the Late Cretaceous of Provence (south-eastern France)

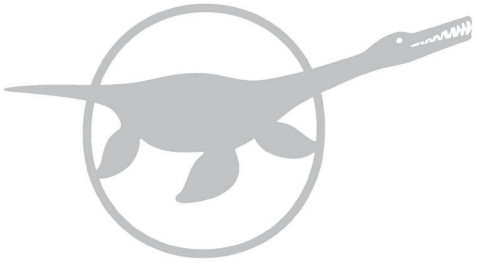
Eric Buffetaut[1], Patrick Mechin[2], Annie Mechin-Salessy[2] and Delphine Angst[3]

[1] CNRS (UMR 8538), Laboratoire de Géologie de l'Ecole Normale Supérieure, 24 rue Lhomond, 75231 Paris Cedex 05, France. eric.buffetaut@sfr.fr

[2] 13127 Vitrolles, France

[3] Laboratoire de Géologie de Lyon, CNRS UMR 5276, 2 rue Dubois, 69622 Villeurbanne Cedex, France.

The giant bird *Gargantuavis philoinos* Buffetaut & Le Loeuff, 1998 was hitherto known from a few specimens (Buffetaut & Angst, 2013), consisting of a synsacrum fragment, a pelvis, an incomplete femur and a cervical vertebra, from four Late Cretaceous localities in southern France. The Bastide-Neuve locality at Fox-Amphoux (Var, south-eastern France), where the first specimen (the synsacrum fragment) was found, has recently yielded two incomplete pelves, each consisting of the synsacrum with articulated remains of the ilia. One of the specimens has undergone considerable dorsoventral crushing, thus resembling the holotype specimen from Campagne-sur-Aude (Aude, south-western France), with which it corresponds in every respect. The other specimen has undergone some lateral distortion but is uncrushed dorsoventrally and thus provides additional evidence about the pelvic morphology of *Gargantuavis*. The new specimens confirm that the synsacrum of *Gargantuavis* includes at least ten completely fused vertebrae. The synsacrum is very bird-like, being markedly arched, with a concave ventral margin. The synsacral vertebrae are pneumatic, with a large longitudinal canal located ventral to the spinal canal and extending for the whole length of the synsacrum. The bony bar formed by the fused neural processes of the synsacral vertebrae is pneumatised, too. The ilia do not meet dorsally. The cup-shaped acetabulum is in an anterior position, being located at the level of the third to fifth synsacral vertebrae. The antitrochanter is in a posterodorsal position (an avian character). The new specimens from Provence thus confirm that *Gargantuavis philoinos* is an archaic bird (Buffetaut & Le Loeuff, 2011), the exact systematic position of which remains uncertain.



Bone microstructure provides new evidence for terrestrial lifestyle adaptations for the Lower Triassic stereospondyl *Lydekkerina* (Tetrapoda: Temnospondyli)

Aurore Canoville and Anusuya Chinsamy

University of Cape Town, Department of Biological Sciences, Private Bag X3, Rhodes Gift, 7701, SOUTH AFRICA; E-mails: aurore.canoville@uct.ac.za, anusuya.chinsamy-turan@uct.ac.za

Aside from macromorphological studies, additional information about the biology of extinct vertebrates can be inferred from the microstructure of fossil bones. Although bone histology has been extensively applied to the diverse non-mammalian therapsids from the Karoo Basin of South Africa, few studies have been conducted on amphibians, which were fairly abundant in the Permo-Triassic ecosystems. *Lydekkerina huxleyi*, a basal and small stereospondyl dominated the amphibian fauna of the South African Lower Triassic *Lystrosaurus* assemblage zone. Even though the anatomy of this amphibian has been described in detail, this taxon remains enigmatic in term of growth strategies and lifestyle habits. In previous studies, the uniformity in skeleton sizes has been attributed to a predominance of subadult and adult specimens recovered. Moreover, anatomical and taphonomic data suggest that the relatively small size of this genus, compared to its Permo-Triassic relatives, could be linked to a shortened developmental period as an adaptation to maintain successful breeding populations under difficult environmental conditions. *Lydekkerina* has been described as either aquatic or mostly terrestrial. The latter hypothesis is controversial as Triassic stereospondyls are generally considered as aquatic or semi-aquatic animals. The current study utilizes histological and microanatomical data to re-assess previous hypotheses pertaining to the biology and ecology of *Lydekkerina*. Bone microstructure of various skeletal elements of several specimens is analyzed to better understand its growth strategies, intra-skeletal variability and lifestyle adaptations. Bone histology reveals that our sample comprises individuals at different ontogenetic stages, i.e. from juvenile to mature individuals. Our results confirm that these amphibians presented a strategy of fast and sustained growth to reach sexual maturity quickly. The microanatomy of the long bones, with their thick bone walls and distinctive medullary cavity, suggests that *Lydekkerina* may have been amphibious with a tendency to be more terrestrial.This study suggests that *Lydekkerina* employed a particular growth strategy and lifestyle, which may have enabled it to prosper during the harsh dry conditions of the Early Triassic.

The continental bony fish assemblage from the Cenomanian (Late Cretaceous) of the Ifezouane Formation, SE Morocco

Lionel Cavin [1], Larbi Boudad [2], Emilie Läng [1], Jérôme Tabouelle [3], Haiyan Tong [4]

[1] Dpt de Géologie et de Paléontologie, Muséum d'Histoire Naturelle de la Ville de Genève, CP 6434, 1211 Geneva 6, Switzerland (FNS grant 129923).
[2] G2FS, Faculté des Sciences et Techniques, BP, 509, Boutalamine, Errachidia, Morocco
[3] Section des Sciences de la Terre et de l'Environnement, Université de Genève, 1205 Genève, Switzerland
[3] Musée d'Elbeuf – La Fabrique des Savoirs-CREA, 76500 Elbeuf-sur-Seine, France
[4] Palaeontological Research and Education Centre, Mahasarakham University, Kantarawichai, Mahasarakham 44150, Thailand

The Ifezouane Formation, forming the lower part of the deltaic deposits of the so-called Kem Kem Beds, which surrounds the Palaeozoic Tafilalet and Maider basins in SE Morocco has yielded one of the richest continental vertebrate assemblage for that period of time.
Here we present an overview of the bony fishes (Dipnoi, Actinistia and Actinopterygii) found in the Ifezouane Formation, which consists of anatomic and systematic revisions of taxa based on the literature and of description of new specimens found during fieldtrips conducted in 2008, 2010, 2012 and 2013. The bony fish component of the assemblage, including coelacanths, lungfishes and ray-finned fishes, is diversified and shows peculiar ecological features. In particular, it is composed of a wide variety of taxa from ancient lineages, such as cladistians and holosteans (amiiforms and ginglymodians), while teleosts, which experimented a radiation event in Cenomanian marine environments, are very rare. Another peculiarity of the assemblage is the occurrence of specimens of very large size, in particular for coelacanths, cladistia and the tselfatiiform *Concavotectum*. We have evidence, based on the ratio of carnivorous versus plant-eating dinosaur remains calculated from a sample collected in the field, that the diversified fish fauna sustained directly the higher levels of the terrestrial food-chain. Finally, although some restricted fossiliferous spots have yielded endemic fish assemblage, most of the Ifezouane fish taxa found in Moroccan localities are represented by similar or closely related taxa in several Early Cenomanian North African localities. This indicates the occurrence of very widespread and rather homogeneous palaeoenvironments extending along the Southern Tethyan margin from Morocco to Egypt.

A new seabird assemblage from central Chile, and their Pliocene record in the Southeastern Pacific

Martin Chavez-Hoffmeister[1], Jorge Carrillo-Briceño[2] and Sven Nielsen[3]

[1]School of Earth Sciences, University of Bristol, Wills Memorial Building, Queens Road, BS8 1RJ, Bristol, UK, glmfch@bristol.ac.uk
[2]Paleontological Institute and Museum, University of Zurich, Karl-Schmid-Strasse 4, CH-8006.
[3]Instituto de Ciencias Ambientales y Evolutivas, Universidad Austral de Chile, Valdivia, Chile.

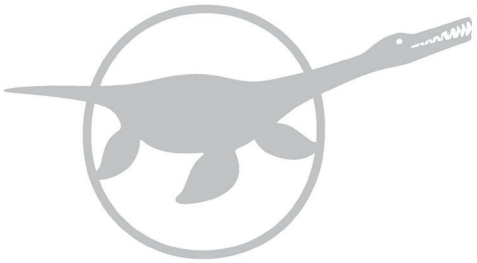
Penguins are the most common fossil birds in the Neogene marine formations of Chile; however, most of their record comes from the Bahia Inglesa Formation and another two areas in arid northern Chile. In consequence, our knowledge of the evolutionary history of penguins, and seabirds in general, in the temperate and cool regions of the Southeastern Pacific is negligible. This gap in the fossil record is even more relevant considering the possible presence of the Subantarctic genus *Pygoscelis* in the Upper Miocene and Upper Pliocene of Bahia Inglesa. In this context, the discovery of a new assemblage of fossil birds in the coastal locality of Horcon in the Valparaiso Region of central Chile offers a unique opportunity to help to fill this lacuna for temperate areas. The new specimens were found in the Late Pliocene Horcon Formation along with remains of other vertebrates and invertebrates. Isolated bones of a medium-sized penguin are the most abundant fossil birds in the area. The morphological and cladistics analysis reveal that these specimens represent a new species of the extant genus *Eudyptes*, the crested penguins from temperate and subantarctic regions and currently restricted two southern Chile. Additionally, a partial skeleton of a small species of cormorant (*Phalacororax* sp.) and a partial tarsometatarsus of a shearwater (*Ardenna* sp.) have been identified. A similar species of cormorant is known from the Pliocene of the La Portada (northern Chile) and Pisco Formations (Southern Peru), whereas shearwaters have been mentioned for the Late Miocene of the Bahia Inglesa (northern Chile) and Pisco Formations (Southern Peru). This suggest the existence of a mixed avifauna, with the presence of a cormorant species shared with the north of Chile and South of Peru and a previously unrecorded genus of penguin currently restricted to cooler regions. The significance of this record in context with their associated fauna, and the record from other Pliocene formations from the Southeastern Pacific, is discussed in this paper.

Insight into the growth dynamics of the Late Cretaceous bird *Gargantuavis* from bone histology.

Anusuya Chinsamy[1], Eric Buffetaut[2], Aurore Canoville[1] & Delphine Angst[3].

[1]Department of Biological Sciences, University of Cape Town, Private Bag X3, Rhodes Gift, 7701, Cape Town, South Africa
[2]CNRS, UMR 8538, Laboratoire de Géologie de l'Ecole Normale Supérieure, Paris, France
[3]CNRS, UMR 5276, Laboratoire de Géologie de Lyon, Villeurbanne, France.

Gargantuavis philoinos, described by Buffetaut & Le Loeuff (1998) as a Late Cretaceous bird about the size of an ostrich, is currently known from a few postcranial elements from Late Cretaceous localities in southern France. Its avian nature has been questioned, and pterosaur affinities suggested, although this is highly controversial. Given the enigma that *Gargantuavis* has posed over the years, we undertook a histological assessment of the bone microstructure of *Gargantuavis* to decipher more information about its biology. A diaphyseal core of the *Gargantuavis* femur (MDE-A8) was taken and embedded in Epofix resin. Three thin sections were prepared. The sections were examined under a Nikon DS-Fi1 dissection microscope and a Nikon Eclipse E200, and NIS elements version 3.0 was used for measurements and photomicroscopy. The microanatomy revealed a fairly thick compact bone wall (average maximum bone wall thickness of three sections was 7930.4 microns). The compacta was clearly stratified into 3 major layers: An outer more poorly vascularised, lamellar layer of bone making up about 27% of the total bone wall; a middle layer of more vascularised bone tissue, with sparse secondary osteons in a parallel-fibred bone matrix; and lastly a narrow inner circumferential layer (ICL) that lined the medullary cavity. The outer layer possibly corresponds to the outer circumferential layer (OCL) described in many extant bird species, but it is distinctive in comprising a poorly vascularised lamellar type of tissue with several growth rings. The change from a more rapid earlier rate of bone deposition to this more slowly formed outer bone tissue is marked by an annulus, which is followed by 5 distinctive lines of arrested growth (LAGs) and an additional 3-4 closely spaced rest lines. The endosteal margin of the bone is not very well preserved, but in places, an inner circumferential layer is evident and a few growth marks are evident here. These histological findings suggest that the *Gargantuavis* grew rapidly during its juvenile phase of ontogeny, but once sexual maturity was reached (as is reflected by the single annulus) its growth rate declined. Thereafter, the animal experienced protracted growth for another 5 years to reach skeletal maturity. The closely spaced rest lines in the peripheral region indicate that appositional growth had virtually ceased, and we deduce that the femur sampled was from a fully grown individual. The bone tissues evident in the *Gargantuavis* section are quite distinctive from that of nonavian theropod dinosaurs, as well as from that of pterosaurs. Histological characteristics of *Gargantuavis* femur appear to resemble that of the extinct order of ratites Dinornithoformes (moa), while the extended skeletal growth evident is similar to that reported for several of the more slowly growing emeids.

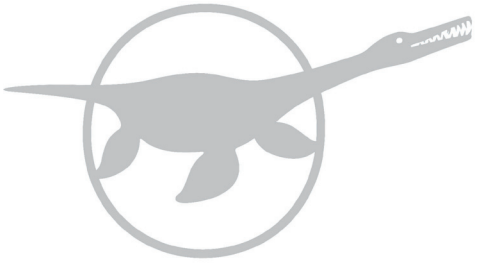


Palaeobiological deductions from the bone histology of the Early Cretaceous bird *Confuciusornis sanctus.*

Anusuya Chinsamy, Luis M. Chiappe[1] and Jesús Marugán-Lbobón[2]

[1]University of Cape Town, Zoology Department, Private Bag, Rondebosch, 7700, South Africa.
[2] Natural History Museum of Los Angeles County, 900 Exposition Boulevard, Los Angeles CA 9007, USA.
[3]Unidad de Paleontologia, Dpto. Biologia. Universidad Autonoma de Madrid. 28049 Cantoblanco (Madrid), Spain.

The basal pygostylian bird *Confuciusornis sanctus* is well known from the Early Cretaceous lake deposits of Northeastern China. Hundreds of these birds have been recovered, and they show striking variations in body size and in plumage. Although unconfirmed, specimens with long, ornamental rectrices (tail feathers) are generally interpreted as males and those without them as females The current study investigates the bone microstructure of long bones of different sized individuals of *Confuciusornis* to assess life history patterns. In addition we examine multiple bones from single skeletons of *C. sanctus* to assess skeletal variation, as well as multiple bones from individuals which show obvious differences in plumage. Sampled bones were embedded in Epofix resin and thin sections were prepared using standard methodologies. The sections were examined under a Nikon DS-Fi1 dissection microscope and a Nikon Eclipse E200, and NIS elements version 3.0 was used for measurements and photomicroscopy. Our analyses revealed variations in terms of histological characteristics such as bone texture, extent of vascularization and presence of growth marks. We show that histological features in the skeleton are related to ontogenetic age, and we also document differences in the histology of different bones of single skeletons. In a specimen of *C. sanctus* (DNHM-D1874) devoid of ornamental tail feathers, we identified medullary bone, a tissue unique to reproductively active female birds. This finding provides unequivocal evidence that individuals of *C. sanctus* without ornamental rectrices are females. Furthermore, by identifying the gender of recovered *Confuciusornis* specimens, our results provide insight into the onset of sexual maturity and attainment of adult body size of this 125-million-year-old bird, and it also demonstrates the evidence of sexual selection in the early evolution of birds.



A new Late Cretaceous vertebrate locality from Valencia province, Spain

Julio Company [1] & Xabier Pereda-Suberbiola [2]

[1]Departamento de Ingenieria del Tereno, UPV, 46022 Valencia, Spain. <company@uv.es>
[2]Departamento de Estratigrafía y Paleontología, UPV/EHU, 48080 Bilbao. <xabier.pereda@ehu.es>.

Recent field work carried out in Late Cretaceous deposits of the Southeastern margin of the Iberian Range, near the village of Beniganim (Valencia province, eastern Spain) has yielded a new continental vertebrate assemblage, mainly dominated by reptiles. The fossils come from the upper part of a Late Maastrichtian succession composed of micritic limestones interbedded with green marls. The facies indicate a continental sedimentation in shallow-water conditions, in a coastal environmet. This palustrine-lacustrine sequence grades downwards to marine limestones, and is overlain by detrital deposits, which are probably Maastrichtian-Paleogene in age. A magneostratigrafic study is being conducted to determine the age of the sedimentary sequence.

The macrovertebrate assemblage of the new locality is composed of bony fishes, chelonians, crocodilians and dinosaurs. In addition, screenwashing sediments yielded fresh-water gastropods, oysters and internal moulds of indeterminate bivalves, ostracodes, and characeans. The actinopterygians are represented by isolated vertebrae, scales and teeth of pycnodontids and lepisosteids. Chelonian remains are quite abundant, and consist of fragmentary dermal plates of pleurodire turtles (cf. *Polysternon*). Crocodilians are only known by scarce fragmentary isolated teeth. Dinosaur remains consists of osteoderms, distal caudal vertebrae and fragmentary limb bones of titanosaurian sauropods. The absence in the vertebral elements of the autapomorphies of *Lirainosaurus*, the only one titanosaur described in the Valencia province, and the robustness of the recovered appendicular elements, suggest the presence of a second, and more massive titanosaur in the Late Cretaceous of Valencia province.

The composition of the new vertebrate faunal association is similar to that of other Campanian-Maastrichtian localities from southwestern Europe, such as Chera and Laño, in the Iberian Peninsula.

Acknowledgements

Our greatest gratitude goes to Manuel Cerdá who discovered the new locality. Financial support for this research was provided by the granted projects CGL2010-16447/BTE and CGL2010-18851/BTE of the Ministerio de Economía y Competitividad (MINECO) of Spain.

Ungulate diets through the Cenozoic of Europe inferred from dental mesowear: report on the first steps of the analysis

Loïc Costeur [1], Laure Bapst [2], Florent Hiard [2], Damien Becker [3]

[1] Naturhistorisches Museum Basel, Augustinergasse 2, 4001 Basel, Switzerland. loic.costeur@bs.ch
[2] University of Fribourg, Department of Geosciences, Chemin du Musée 6, 1700 Fribourg, Switzerland. laure.bapst@unifr.ch; florent.hiard@unifr.ch
[3] Musée jurassien des sciences naturelles, route de Fontenais 21, 2900 Porrentruy, Switzerland. damien.becker@jura.ch

Cenozoic European continental environments and climates have been investigated through different approaches involving plant-based reconstructions (palyonology and macrofossils, e.g., Mosbrugger *et al.* 2005), mammal community analyses (e.g., Legendre, 1989) and various other proxies such as fish or reptile diversity (e.g., Böhme, 2003, 2004). They often focussed on short time frames characterized by good proxy data.
The Cenozoic record of European ungulate mammals is very broad and continuous. It represents an incredible amount of ecomorphological data that relate morphological patterns to the ecology of the animals and thus to the environment they lived in. Tooth crown height (hypsodonty) and wear (mesowear) have been used to infer dietary preferences of various kinds of mammals including perissodactyls and artiodactyls, with a good control on extant species (e.g., Louys *et al.* 2012). The analysis of hypsodonty and mesowear has proved very powerful in reconstructing the diet of fossil species. Mihlbachler *et al.* (2011) recently studied the dietary changes in North American horses and related their results to large scale environmental and climatic trends over more than 55 million years.
Given the large European record available we started recording the Hypsodonty Index (HI, sensu Janis 1988) and the Mesowear Score (MS, see Fortelius & Solounias 2000, Mihlbachler *et al.*, 2011 and Louys et *al.,* 2012) for all the perissodactyl and artiodactyl species we can access starting in the Eocene. The very first results of this long-term project indicate, in accordance with Mihlbachler *et al.*'s results, a browsing diet for the Eocene species. Perissodactyls and artiodactyls studied so far are almost all brachydont (HI < 1.5) with low Mesowear Scores. The impact of the arrival of selenodont artiodactyls in the middle Eocene, then later that of ruminants, as well as the development of true rhinocerotids, tapirids and anthracotheriids in the Oligocene are of particular interest. The links between their dietary signals and the terrestrial environmental evolution will be investigated. This project has just started and we present here our first results. We hope to be able to sample as much taxa as we can in order to address potential phylogenetic effects that may indicate evolutionary signals.

Early Cretaceous dinosaur remains from Dobrogea (southeastern Romania)

Zoltán Csiki-Sava[1], Vlad Codrea[2] & Ştefan Vasile[3]

[1] Department of Geology, Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania;
[2] Faculty of Biology and Geology, University Babeş-Bolyai, Cluj-Napoca, Romania;
[3] Department of Geology, Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania

The dinosaurian fossil record of Romania is dominated by far by the latest Cretaceous dinosaurs of the Transylvanian region, seconded by the Early Cretaceous dinosaur assemblage described from bauxites of the northern Apuseni Mountains (e.g., Grigorescu, 2003; Codrea *et al.*, 2010, 2012; Vasile & Csiki, 2011). Both of these assemblages originate from inside the Carpathian Orogen, which places them paleogeographically within the northern edge of the Tethyan Realm.

On the other hand, the dinosaurian fossil record is extremely poor in the extra-Carpathian, cratonic areas of Romania, where it was represented for over a century by an isolated theropod tooth reported from the Lower Cretaceous shallow-marine deposits of southern Dobrogea and referred to the waste-basket taxon *Megalosaurus* (Simionescu, 1913). This tooth, now in the collections of the Al. I. Cuza University, Iaşi, Romania, was largely neglected after its original description, although it was often cited simply as a dubious occurrence data (e.g., Holtz *et al.*, 2004). We have recently re-examined this tooth, in order to re-assess its phylogenetic affinities, and also to establish more precisely the place of origin and the age of the specimen.

Besides this isolated theropod tooth, a second dinosaurian specimen from southern Dobrogea was recently identified in the collections of the National Geological Museum (Geological Survey of Romania), Bucharest. It is represented by a caudal vertebral centrum which, despite its lower diagnostic value, documents both a higher diversity and a wider chronostratigraphic range of the group in the southeastern, cratonic Romanian territory

.

This contribution is supported by the CNCS grant PN-II-ID-PCE-2011-3-0381 (to V. Codrea).

References

Codrea, V., Godefroit, P., Smith, T., 2012. In Godefroit, P. (ed.), *Bernissart Dinosaurs and Early Cretaceous Terrestrial Ecosystems*. Indiana University Press, Bloomington, pp. 570–581.

Codrea, V., Vremir, M., Jipa, C., Godefroit, P., Csiki, Z., Smith, T., Fărcaş, C., 2010. *Palaeogeography, Palaeoclimatology, Palaeoecology*, 293: 391–405.

Grigorescu, D., 2003. *Comptes Rendus Palevol*, 2, 97–101.

Holtz, T.R., Molnar, R.E., Currie, P.J., 2004. In Weishampel, D.B., Dodson, P., Osmolska, H. (eds.), *The Dinosauria. Second Edition*. University of California Press, pp. 71–110.

Simionescu, I., 1913. *Centralblatt für Mineralogie, Geologie und Paläontologie*, 1913, 20, 686–687.

Vasile, S., Csiki, Z., 2011. *Oltenia. Studii şi comunicări. Ştiintele Naturii*, 27, 1, 221–230.

Review of the latest Cretaceous Albanerpetontidae from Haţeg Basin (Romania)

Zoltán Csiki-Sava[1],Márton Venczel [2] & Ştefan Vasile[3]

[1] Department of Geology, Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania;
[2] Ţării Crişurilor Museum, Oradea, Romania;
[3] Department of Geology, Faculty of Geology and Geophysics, University of Bucharest, Bucharest, Romania

Albanerpetontid amphibians were relatively widespread and are well known from North America and Europe, with multiple occurrences ranging from the Middle Jurassic to the Upper Pliocene (for a review, see Gardner & Böhme, 2008). Although their Upper Cretaceous occurrences are fairly numerous in Europe, including elements which allow a positive assignment to the family, more diagnostic elements are rare and fragmentary, thus precise taxonomical affinities remain difficult to discern.

As in other European localities, the Maastrichtian sites from Romania yielded a number of amphibian remains of undisputed albanerpetontid origin. Their previous referral to the genus *Albanerpeton* was based on fragmentary frontals, whereas their specific assignment remained unclear (Grigorescu *et al.*, 1999; Folie & Codrea, 2005).

Diverse and better preserved additional material, recently discovered in the Maatrichtian of the Haţeg Basin, confirms the presence of the genus *Albanerpeton*, and offers supplementary information concerning its affinities. This material allows a better specific assignment of the Haţeg albanerpetontids, a series of cranial elements being closely related, even possibly belonging, to *A. inexpectatum*. As this taxon was previously described only from Cenozoic deposits, its possible range extension into the Late Cretaceous might offer new insights into the paleobiogeograhy and evolution of European albanerpetontids.

Acknowledgments: This research received support from the SYNTHESYS Project (http://www.synthesys.info/) which is financed by European Community Research Infrastructure Action under the FP7 "Capacities" Program (SV), as well as from the CNCS grant PN-II-ID-PCE-2011-3-0381 to V. Codrea (ZCs-S, MV).

References:

Folie, A., Codrea, V., 2005. New lissamphibians and squamates from the Maastrichtian of Haţeg Basin, Romania. *Acta Palaeontologica Polonica*, 20, 1: 57–71.

Grigorescu, D., Venczel, M., Csiki, Z., Limberea, R., 1999. New latest Cretaceous microvertebrate fossil assemblages from the Haţeg Basin (Romania). *Geologie en Mijnbouw*, 78: 301–314.

Gardner, J. D.. Böhme, M., 2008. Review of Albanerpetontidae (Lissamphibia), with comments on the palaeoecological preferences of Tertiary European albanerpetontids. *In*: Sankey, J. T., Baszio, S. (eds.), *Vertebrate Microfossil Assemblages: Their role in Paleoecology and Paleobiogeography*. Indiana University Press, pp. 178–218.

Associated skeletal and dental remains of a fossil odontaspidid shark from the Middle Eocene of Denmark

Gilles Cuny[1], Bitten Bolvig Hansen[1], Bo Wilhelm Rasmussen[1], Kenshu Shimada[2,3], Perri Jacobs[3] & Claus Heilmann-Clausen[4]

[1] Natural History Museum of Denmark, University of Copenhagen, Øster Voldgade 5-7, 1350 Copenhagen, Denmark. E-mails: gilles@snm.ku.dk; bottenhansen@hotmail.com; bwrasmussen@snm.ku.dk

[2] Department of Environmental Science and Studies, DePaul University, 1110 W. Belden Avenue, Chicago, Illinois 60614, USA, and Sternberg Museum of Natural History, 3000 Sternberg Drive, Hays, Kansas 67601, USA. E-mail: kshimada@depaul.edu

[3] Department of Biological Sciences, DePaul University, 2325 N. Clifton Avenue, Chicago, Illinois 60614, USA. E-mail: perrijacobs@gmail.com

[4] Department of Geoscience, Aarhus University, 8000 Aarhus C, Denmark. E-mail: claus.heilmann@geo.au.dk

The Middle Eocene Lillebælt Clay Formation in Denmark is well known for various remains of fossil sharks (Chondrichthyes: Elasmobranchii), but almost nothing has been published on the subject. A set of associated vertebrae and teeth of a fossil shark individual was recently collected from this formation and declared Danekræ. Its vertebral morphology indicates that the individual belongs to an odontaspidid shark (Lamniformes). Although it is here identified as Odontaspididae indet., its tooth morphology suggests that the fossil shark possibly belongs to an undescribed taxon closely allied to *Odontaspis* or *Palaeohypotodus*. On the basis of the largest preserved vertebrae and comparisons with vertebrae of extant *Odontaspis ferox*, the fossil individual possibly measured about 325 cm in total length. The disarticulated nature of the fossil shark components in a low-energy deposit indicates that the shark carcass must have been lying on the sea floor for some time. The fossil individual was found with a possible shed tooth of another odontaspidid taxon, *Palaeohypotodus* sp., indicating that odontaspidid sharks were common during the Middle Eocene in the area.

Morganucodonta from Saint-Nicolas-de-Port (Upper Triassic, France): origin of mammiliaformes and T/J crisis

Maxime Debuysschere

Muséum national d'histoire naturelle,CR2P - UMR 7207 CNRS, MNHN, Univ Paris 06, 57 rue Cuvier, CP 38, F-75005, Paris, France
Key-words: France, Lorraine, Trias, Mammaliaformes, Morganucodonta, mammalian origin, Trias-Jurassic crisis, teeth

The locality of Saint-Nicolas-de-Port, from the Upper Triassic of North Eastern France, has given an enormous amount of fossils from a highly diversified fauna. My study of mammalian teeth kept in MNHN adds 5 genera (*Megazostrodon*, cf. *Paceyodon*, *Paikasigudodon* and 2 new genera) and 2 indeterminate taxa to the morganucodontan assemblage. The genus *Brachyzostrodon*, previously described, is reviewed here. There are now at least 7 species of morganucodonts in SNP. An unresolved debate about dental homology prevents a cladistic analysis. The present work is interesting for several reasons. The diversification of morganucodonts took place before Rhaetian. The mammalian micro-fauna was relatively cosmopolite. This fauna didn't change through the Triassic/Jurassic boundary. More studies about Saint-Nicolas-de-Port will be useful on questions such as the origin of mammals and the Triassic-Jurassic boundary.

Evolutionary trends and integration patterns in the conodont genus *Polygnathus*

Soledad De Esteban-Trivigno[1,2], Carlos Martínez-Perez[3]

[1] Transmitting Science, Gardenia 2, Can Claramunt, 08784 Piera, Barcelona, Catalonia, Spain; soledad.esteban@transmittingscience.org
[2] Institut Català de Paleontologia, Cerdanyola del Valles, Catalonia, Spain.
[3]School of Earth Sciences, University of Bristol, Wills Memorial Building, Queen's Road, Bristol BS8 1RJ, United Kingdom. E-mail: Carlos.Martinez-Perez@bristol.ac.uk

The excellent conodont fossil record, spanning over 300 Myr where they exhibited extensive and markedly morphological change, represent an ideal source of information for addressing fundamental issues of pattern and process in evolutionary theory. However, this potential has not been exploited, and only a handful of conodont evolutionary studies incorporate a morphological quantitative framework (see Jones, 2009 and references therein). In this context, this work intend to unravel, using geometric morphometric methods, the early evolutionary trends and integration patterns of the genus *Polygnathus* during the Emsian Stage (Devonian), the most diverse and wide-spread Devonian to Lower Carboniferous conodont genus.

Geometric morphometrics methods allow capturing the shape of the studied object and comparing it to other individuas. According to this, we have defined 8 landmarks on 213 conodonts from 18 species of the genus *Polygnathus* during their first 15 Myr of evolution. After digitalization, Generalized Procrustes Superimposition (GPA) was carried out and the residuals were analyzed with different methods using MorphoJ software.

There was a clear phylogenetic signal in the shape data; concordant with the fact that phylogeny in this group is drawn from morphological characters of the conodont element. Principal Components Analysis (PCA) within species and at evolutionary level were used to analyze the main shape changes in *Polygnathus*. These results suggests that developmental constrains were not playing the main role in *Polygnathus* evolution.

A modularity analysis and Two block Partial Least Squares (PLS) were developed to confirm the modularity hypothesis. These analyses suggest that two modules are present in the conodont element. These modules can be interpreted as functional modules showing important morpho-functional adaptations to improve the occlusion and processing food efficiency of the conodont element.

Finally, the results have shown that conodonts represent an important resource for understanding evolutionary pattern and process in the fossil record.

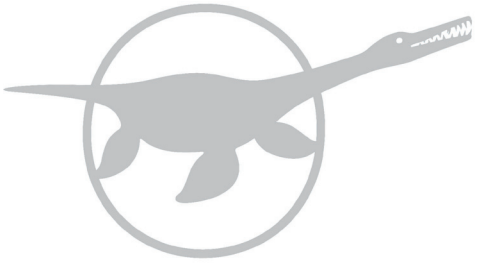
A nearly complete Varanus skeleton from the late Miocene of Cerro de los Batallones (Madrid Basin)

Massimo Delfino[1,2], Juan Abella[2,3], Israel M. Sánchez[3] & David M. Alba[2,1]

[1]Dipartimento di Scienze della Terra, Università di Torino, Via Valperga Caluso 35, 10125 Torino, Italy, massimo.delfino@unito.it;
[2]Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona. . Edifici ICP, Campus de la UAB s/n, 08193 Cerdanyola del Vallès, Barcelona, Spain;
[3]Departamento de Paleobiología, Museo Nacional de Ciencias Naturales–Consejo Superior de Investigaciones Cientificas, c/ José Gutiérrez Abascal 2, 28006 Madrid, Spain

As part of a wider project of revision of the European fossil record of monitor lizards, we studied a recently retrieved nearly complete *Varanus* skeleton from the late Miocene (late Vallesian, MN10) of Batallones 3 (Torrejón de Velasco, Madrid Basin, Spain), housed at the Museo Nacional de Ciencias Naturales (MNCN) in Madrid. This single individual is represented by at least 119 skeletal elements (MNCN BAT-3 2011–200, 148, 252, 2626, 2628, 2629), originally found in close spatial association, corresponding to most of the skull and lower jaw, coracoid, humerus, ilium, femur, tibia and most of the vertebrae. With the exception of the tail vertebrae (preserved in anatomical connection on a slab) and some skull elements (preserved together), all the other remains are isolated. This material is referred to *Varanus marathonensis* on the basis of the morphology of the maxillae: the anterodorsal sloping surface of the facial process is mediolaterally wide and hosts a deep concavity that is medially expanded.
The specimen from Batallones 3 represents by far the most informative *Varanus* material ever reported, since it allowed us to score more than 220 informative morphological characters for the phylogenetic analysis. The other *Varanus* species whose phylogenetic relationships were previously analyzed cladistically provided significantly less morphological characters: 62 for *Varanus amnhophilis*; 46 for *Varanus hooijeri*; 139 for *Varanus priscus*; and 96 for *Varanus rusingensis*. Therefore, thanks to the Batallones skeleton, *V. marathonensis* is the best known extinct species of *Varanus*. Interestingly enough, the character coding of *Varanus marathonensis* is totally redundant with that of the recently described *Varanus amnhophilis*, and being the diagnostic traits of the latter also present in the Batallones specimen, on the basis of the Principle of Priority *V. amnhophilis* is probably a junior subjective synonym of *V. marathonensis*.

Research supported by the Comunidad de Madrid, the Spanish Ministerio de Economía y Competitividad (CGL2008-05813-CO2-01, CGL2011-28681, and RYC-2009-04533 to D.M.A.), Italian MIUR (PRIN 2009MSSS9L_002), and by the SYNTHESYS Project funded by European Community Research Infrastructure Action under the FP7 ‘Structuring the European Research Area’ Programme (ES-TAF-1975).



A new bird from the latest Maastrichtian of North America

Robert A. DePalma,[1] David A. Burnham,[2] Larry D. Martin,[2-4] and Amanda R. Falk[5]

[1] The Palm Beach Museum of Natural History, 2805 E. Oakland Park Blvd., Ft. Lauderdale, FL 3330,6 USA
[2] The University of Kansas Biodiversity Institute, 1345 Jayhawk Blvd., Lawrence, KS 66045, USA
[3,4] The University of Kansas, Department of Ecology and Evolutionary Biology, USA; deceased
[5] The University of Kansas, Department of Geology, Lawrence, KS, USA

Here, we report a new ornithurine bird specimen from the Hell Creek Formation. The fossil consists of a partially articulated skeleton, and is the most complete specimen of its kind thus far discovered in the formation. It is also the first terrestrial ornithurine bird species to be described from the Hell Creek. The skeleton was preserved in a medium- to fine-grained laminated clay-pebble conglomerate that was deposited in a low-energy stream channel that had a high sedimentation rate. The site is stratigraphically close to the K-T boundary (<20 m below the boundary), within the HC III floral zone (DePalma 2010), and dates to approximately 65 MYA. Overall morphology of the skeleton is consistent with a water-marginal habitat, and specific morphology, more notably the shoulder and hip region, is reminiscent of modern Gruiformes. A phylogenetic study places it as a basal member of the Rallidae within the phylogeny proposed by Livezey. The highly advanced and derived morphology of the specimen closely resembles modern forms, and indicates that more basal forms may have existed closer to the initial emergence of the Gruiformes at some point earlier in the Cretaceous. Van Tuinen et al. (2006) suggest that superordinal groups of extant birds began to emerge around 100 million years ago, followed by modern orders 90–80 million years ago, and diversification occurring rapidly thereafter, a theory consistent with the present specimen.

Literature Cited

DePalma, R. 2010. Geology, Taphonomy, and Paleoecology of a Unique Upper Cretaceous Bonebed near the Cretaceous-Tertiary Boundary in South Dakota: Master's Thesis, University of Kansas.

van Tuinen, M., and Dyke, G. 2004. Calibration of Galliform Molecular Clocks using Multiple Fossils and Genetic Partitions. Molecular Phylogenetics and Evolution 30(1): 74-86.

Dorsal vertebrae of a juvenile titanosaur from the Late Cretaceous of "Lo Hueco" (Cuenca, Spain)

Verónica Díez Díaz[1] and Francisco Ortega[2]

[1]Universidad del País Vasco/Euskal Herriko Unibertsitatea, Facultad de Ciencia y Tecnología, Apdo. 644, 48080 Bilbao, Spain. diezdiaz.veronica@gmail.com;
[2]Grupo de Biología Evolutiva. Facultad de Ciencias. UNED. Senda del Rey 9 28040. Madrid, Spain. fortega@ccia.uned.es

The fossil site of "Lo Hueco" from the Late Cretaceous of Cuenca (central Spain) has yielded more than 8000 fossil remains, 49 % referred to titanosaurian sauropods. Recent studies hypothesize the presence of several titanosaurian morphotypes corresponding to, at least, two different taxa. Two of these morphotypes are also present in several sites from France (Díez Díaz *et al.*, 2012; Knoll *et al.*, 2013). A third one could have been a gracile morphotype not known in other sites until now.

Here we present five small titanosaurian dorsal vertebrae (they are non consecutive, but most likely belonging to a single individual) found at "Lo Hueco". The neural arch and the centrum are not completely co-osified in two of them, so they probably belonged to a juvenile individual. The centra are long and opisthocoelous, being dorsoventrally compressed in the more anterior vertebrae. They show an eyed-shaped pleurocoel at their lateral surfaces. The neural spine is low and posterodorsally oriented. The diapophyses are almost horizontally oriented. These vertebrae present a complex lamination, which surrounds numerous deep fossae. The most striking features of these specimens are the presence of a stranded prespinal lamina and a longitudinal ridge in the interpostzygapophyseal lamina in the most anterior ones, and a stranded posterior parapophyseal lamina in the most posterior ones (sensu Wilson, 2013).

These vertebrae present a characters combination corresponding to a lithostrotian titanosaur. They do not share the diagnosis of any of the Iberoarmorican titanosaurs know until now, but further adscription has to be cautelous as they correspond to a juvenile individual. The study of the rest of the titanosaurian remains from "Lo Hueco" will help to assess the taxonomic status of these dorsal vertebrae and probably shed light to understand the ontogenic character transformation of one of the taxon represented in the site.

Díez Díaz, V., Le Loeuff, J., Ortega, F., Pereda Suberbiola, X., and Sanz, J.L. 2012. Titanosaurs: the largest vertebrate settlers of the Ibero-Armorican Island. Fundamental!, 20: 67-69.

Knoll, F., Ridgely, R.C., Ortega, F., Sanz, J.L., and Witmer, L.M. 2013. Neurocranial Osteology and Neuroanatomy of a Late Cretaceous Titanosaurian Sauropod from Spain (Ampelosaurus sp.). PLoS ONE 8 (1): e54991. doi:10.1371/journal.pone.0054991

Wilson, J.A. 2012. New vertebral laminae and patterns of serial variation in vertebral laminae of sauropod dinosaurs. Contributions from the Museum of Paleontology, University of Michigan 32: 91–110.

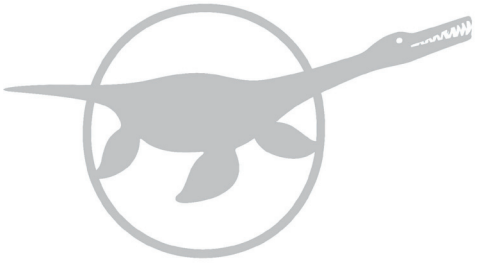
Lirainosaurus astibiae: new insights into the best known European titanosaur

Verónica Díez Díaz[1], Xabier Pereda Suberbiola[1] and José Luis Sanz[2]

[1]Universidad del País Vasco/Euskal Herriko Unibertsitatea, Facultad de Ciencia y Tecnología, Apdo. 644, 48080 Bilbao, Spain. diezdiaz.veronica@gmail.com (V.D.D.); xabier.pereda@ehu.es (X.P.S.);
[2]Unidad de Paleontología. Dpto. de Biología. Universidad Autónoma. C/ Darwin, 2. 28049 Madrid, Spain. dinoproyecto@gmail.com

Lirainosaurus astibiae, first described by Sanz *et al.* in 1999, is the only titanosaurian genus and species described in the Iberian Peninsula until now. The type material from the site of Laño (Condado de Treviño, northern Spain) preserves both cranial (basicrania, teeth) and postcranial material, comprising vertebrae, appendicular remains and dermal armour. Recently, postcranial remains from two localities in Valencia and Guadalajara have been referred to *Lirainosaurus* (Company, 2011; Company *et al.*, 2009; Ortega and Pérez-García, 2009). *Lirainosaurus astibiae* presents a unique combination of characters within the titanosaurs (Díez Díaz, 2013; Díez Díaz *et al.*, 2011; in press; under review): the presence of a foramen in the distal surface of the basal tubera; absence of medial subcondylar depressions or foramina in the basicranium (although this could be due to the ontogeny); presence of a postzygadiapophyseal lamina (podl) in the proximal caudal vertebrae, which separates the postzygacentrodiapophyseal (pocdf) and the postzygaspinodiapophyseal (posdf) fossae; the spinopostzygapophyseal structure of the posterior caudal vertebrae is not posteriorly projected; presence of a dorsal prominence and a ventral ridge in the medial surface of the scapular blade; combination of an anterolateral process and an anteroventral ridge in the sternal plate; presence of a rounded buldge in the posterolateral surface of the humerus; and the distal end of the tibia shows a subquadrangular profile. Ontogenetic changes have been observed in the tooth morphology of *Lirainosaurus*, those of the juvenile individuals being smaller and with non-ornamented enamel, and those of the adult individuals being bigger and with wrinkled enamel. In addition, microwear differences in the apical wear facets of the juvenile and adult teeth have been ascertained, suggesting a change in the diet and food processing (Díez Díaz *et al.*, 2012). Equations for predicting body mass and size in sauropods suggest a body size up to 6 meters and a body mass of at least 2-4 tonnes for the largest invididuals of *Lirainosaurus astibiae*, being one of the most slender and small-sized titanosaurs known to date (Díez Díaz, 2013).

These features and the combination of several diagnostic characters also present in the most derived titanosaurs permit to suggest that the Iberian titanosaur *Lirainosaurus astibiae* is closely related to the opisthocoelicaudine saltasaurids.



Following in the footsteps of dinosaurs: ancient avian feeding behaviour from the Haman Formation of South Korea.

Amanda R. Falk[1], Jong-Deock Lim[2], Larry D. Martin[3,4], Stephen T. Hasiotis[1]

[1], The University of Kansas, Department of Geology, Lawrence, KS, USA 66045;
[2], Natural Heritage Center, National Research Institute of Cultural Heritage, 396-1 Mannyeon-dong, Seo-gu, Daejeon 302-834, Republic of Korea;
[3], The University of Kansas, Department of Ecology and Evolutionary Biology and Biodiversity Institute, Lawrence, KS, USA 66045;
[4] deceased

The Lower Cretaceous Haman Formation of South Korea has yielded thousands of well-preserved vertebrate tracks. Examples include avian tracks from the Geyongsangnamdo Institute of Science Education (GISE) near Jinju.where thousands of tracks are preserved on two large exhibit hall floor slabs, and hundreds more are preserved on float blocks. Among the most spectacular are bird tracks inside the tracks of large sauropod dinosaurs, indicating that the tracks were made after the dinosaurs had passed. The presence of arcuate feeding traces of a spoonbill-like ecomorph within sauropod footprints suggests that the birds were following in the dinosaurs' footsteps, possibly collecting invertebrates that the dinosaurs had disturbed, similar to birds following megaherbivores in Africa today. The avian tracks from the GISE site exhibit a wide array of morphologies, including morphologies not found within the body fossil record (Lockley and Harris, 2010), which makes these trace fossils an excellent indicator of hidden diversity of Early Cretaceous avians. Shorebird-like feeding behaviors, such as probe and peck marks have already been described (Falk *et al.*, 2010). Clusters of probe marks, and single, isolated probe marks have both been discovered, implying birds had already evolved multiple patterns of probing by the Early Cretaceous.

References

Lockley, M.G. and Harris, J., 2010, On the trail of early birds: A review of the fossil footprint record of avian morphological evolution and behavior, in Ulrich, P.K., and Willette, J.H., eds., Trends in Ornithological Research: Nova Publishers, Fargo, North Dakota, p. 1–63.

Falk, A.R., Hasiotis, S.T., and Martin, L.D., 2010, Feeding traces associated with bird tracks from the Lower Cretaceous Haman Formation, Republic of Korea: Palaios, v. 25, p. 730-741.

Palaeohistology reveals the maturity of the *Turiasaurus riodevensis* holotype

Francisco Gascó[1], Rafael Royo-Torres[1], Alberto Cobos[1] & Luis Alcalá[1]

[1] Fundación Conjunto Paleontológico de Teruel-Dinópolis. (FCPTD). Avda. Sagunto s/n. 44002 Teruel.
E-mail: gasco@fundaciondinopolis.org

The non-neosauropod sauropod *Turiasaurus riodevensis* was published in 2006. Its size was estimated to be more than 30 m long and to have weighted around 40 tons. That makes *Turiasaurus* the biggest dinosaur described in Europe to date. Since then, the study of this gigantic sauropod has continued, including some biological aspects, such as the functional anatomy. A palaeohistological approach was made to know the age and growth of this individual.

For that purpose, some ribs and long bones were sampled and sliced. Their microscopic study revealed that both kinds of skeletal elements show an extreme secondary ossification. The secondary osteons invade almost all the cortex, sometimes even appearing next to the surface where the EFS (External Fundamental System) appears. The bone tissues identified can be identified as E and F according to Klein & Sander (2008). The Histological Ontogenetic Stage that implies these tissues is HOS 13-14, which means that the holotype of *Turiasaurus riodevensis* was a fully grown mature individual, even possibly a senescent one.

This maturity strengthens the validity of the autapomorphies of *Turiasaurus riodevensis*. Further palaeohistological research will be made on other turiasaurians like the new giant sauropod from San Lorenzo and Puntal de Santa Cruz sites in Riodeva. Knowing their maturity will help us to enlighten the phylogenetic relationships of these sauropods.

Acknowledgements: Departamento Educación, Universidad, Cultura y Deporte, Gobierno de Aragón (projects 201-2010, 201/10-2011, 201/10-11-2012, 201/10-2013); Fundación Conjunto Paleontológico de Teruel-Dinópolis; Fundación SAMCA; FOCONTUR (Grupo de Investigación Consolidado E-62, Departamento de Industria e Innovación, Gobierno de Aragón and Fondo Social Europeo); Ministerio de Ciencia e Innovación/ FEDER (project DINOSARAGÓN CGL2009–07792); Ministerio de Educación y Ciencia (AP2008-00846); and Instituto Aragonés de Fomento.

The billfish *Palaeorhynchus* (Xiphioidei, Palaeorhynchidae) from the Menilitic formation (Oligocene, Sitborice member) at the Litenčice locality (Czech Republic).

Růžena Gregorová[1] and Jeff Liston[2]

[1]Moravian Museum, Department of Geology and Paleontology, Zelny trh 6, 659 37 Brno, Czech Republic. rgregorova@mzm.cz
[2] Yunnan Key Laboratory for Palaeobiology, Yunnan University, Cuihu Beilu 2#, Kunming, Yunnan Province, China, 650091.

The Palaeorhynchidae is regarded as an extinct family of the suborder Xiphioidei with four genera: *Aglyptorhynchus* Casier, 1966, *Palaeorhynchus* Blainville, 1818, *Homorhynchus* van Beneden, 1873 and *Pseudotetrapturus* Danilshenko, 1960 (Fierstine et al. 2008). Twenty fragments of a large fossilised billfish recovered from the world famous Litenčice locality represent the remains of the skull (sclerotic, rostrum, maxilla, gill components), the vertebral column (about 10 centra) with about 9 ribs, parts of the pectoral, dorsal and pelvic fins, as well as scales.

On the basis of our analysis we consider this incomplete specimen to belong to the genus *Palaeorhynchus*: both jaws contribute to the rostrum, villiform teeth are present, the maxillae bear a down-turned flange, there are expanded neural and hemal spines, and cycloid scales of different sizes. From the length of the vertebral centra, we can estimate that this individual was approximately 150 cm in body length. This identifies the specimen as representing one of the longest individuals ever recorded.

This specimen of *Palaeorhynchus* represents the first record in the Menilitic Formation of the Moravian part of the Outer Flysch Carpathians. Whereas in the Eastern (Caucasus) and Western Paratethys including the Rhine graben (e.g. the Froidfontaine locality) and in the Tethys (Glarus and Iran) this taxon is very abundant, in the Carpathian region (Central Paratethys) its occurrence is rather sparse.

This paper was financially supported by the Ministry of Culture of the Czech Republic by institutional financing of long-term conceptual development of the research institution (the Moravian Museum, MK000094862).

Evolution of Hominoids' ecological niche during the Miocene

Noémie Hamon[1,2], William E. Banks[3], Pierre Sepulchre[2], Jean-Jacques Jaeger[1] and Gilles Ramstein[2]

[1]IPHEP, UMR 7262 CNRS - INEE - Universite de Poitiers, Poitiers, France
[2]LSCE, UMR 8212 CNRS – CEA- Université de Versailles Saint-Quentin en Yvelines, Gif-sur Yvette, France
[3]PACEA, UMR 5199 CNRS-Université de Bordeaux, Talence, France

The Miocene (approximately 23 to 5 Ma) is a crucial period in hominoid (ape) evolution. Following their initial radiation in Africa during the early Miocene, hominoids dispersed into Eurasia and became a successful group in Europe in the middle Miocene from which modern hominids are supposed to originate after a return to Africa. However, during the late Miocene, as climate became cooler and dryer, hominoids experienced a series of extinctions, particularly in Europe. Many authors have linked Miocene hominoid evolution to climatic and environmental changes. However, a very few quantitative studies have been performed to go beyond correlations and test the actual impact of climate on the geographic distribution of hominoids. Here, we use climate, vegetation and ecological niche modeling to study the evolution of hominoid distributions as they relate to Miocene climatic changes. On the one hand, our results indicate that, while African and Asian hominoids had similar ecological requirements, European hominoids lived in more seasonal, dryer and cooler conditions. On the other hand, we do not simulate niche continuity between Africa and Europe, even during the wet and warm middle Miocene climatic optimum. Therefore we suggest that the appearance of hominoids in the European fossil record was not due exclusively to ecological niche expansion in response to climatic changes, but also to adaptation. Only the forms that could inhabit more seasonal, dryer and cooler habitats dispersed from Africa to Europe. Moreover, we show that the climate changes between the middle and late Miocene induced a contraction of the geographic distribution of hominoid populations, which may explain the extinctions observed in this period's fossil record. Our results are consistent with the paleontological data and provide new elements for understanding the link between climate, environment and hominoid evolution.

Extinction

Ella Hoch

Gram Museum of Palaeontology, Lergravsvej 2, DK-6510 Gram, Denmark. ellahoch@mail.dk

The concept of species' extinction is alien to settled man who lives off cultivated plants and domesticated animals and is habituated to repetitive monotony. In contrast, the Palaeolithic hunters depending vitally on the large mammals of the Late Pleistocene Mammoth Steppe no doubt conceived of extinction when Holocene forests spread north followed by new animals (Guthrie 2005, Aaris-Sørensen 2010). Hunting peoples may well have carried mythological awareness of extinction.

In Europe, propagation of Christianity liberated believers from such mental burden. The Bible teaches about the origin of life on Earth, with the life forms continuing unchanged from the time of creation some 4-6000 years ago, and even through the dangers of the Great Flood, until Doomsday. Antique philosophy revitalized by the Renaissance researchers on Christian background was equally untarnished by a consciousness of extinction. But hard-won knowledge of the Earth in relation to other 'Heavenly bodies' and of the Earth itself made inroads on the ignorance. Around year 1800, Cuvier's comparative studies of fossil vertebrate skeletons and skeletons representative of the global diversity of extant vertebrates established extinction as a fact. This was the beginning of palaeontology.

Cuvier's demonstration of extinction received less wide, general attention and caused less ideological stir than did Darwin's demonstration of evolution a good half century later, for various non-scientific reasons. The idea of extinction denoted a scientific break-through, whereas evolution may be regarded as a natural precondition to or consequence of extinction. Two sets of reasoning will be presented for relevant consideration, one by René Descartes (1647) on time, the extent of the universe, the equality of man with other creatures, and the possibility that there may be intelligent life on the stars; and one by Sandler (2012) on the ethics of species.

Literature: Aaris-Sørensen, K. 2010. Diversity and dynamics of the mammalian fauna in Denmark throughout the last Glacial-Interglacial cycle, 115-0 kyr BP. Fossils and Strata 57: 1-59. – Descartes, R. 1647. Lettre à [Pierre] Chanut in Bridoux, A. 1966. Oeuvres et lettres de Descartes. Textes présentés par André Bridoux. Gallimard. - Guthrie, R.D. 2005. The Nature of Paleolithic Art. The University of Chicago Press. – Sandler, R.L. 2012. The Ethics of Species. Cambridge.

New information on *Pengornis* from a subadult specimen

Han Hu[1,2], Zhou Zhong-He[1] and Jingmai K. O'Connor[1]

[1] Key Laboratory of Vertebrate Evolution and Human Origin, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing 100044, China
[2] University of Chinese Academy of Sciences, Beijing 100049, China

Known only from the holotype specimen, *Pengornis houi* is the largest known Early Cretaceous enantiornithine bird, important for understanding body size and character evolution in Ornithothoraces. This paper reports on a new subadult specimen from the Lower Cretaceous Jiufotang Formation tentatively referred to *Pengornis* sp. indet. The specimen preserves a nearly complete sternum, reminiscent of that in *Protopteryx* and basal ornithuromorph *Archaeorhynchus*, thus shedding new light on the evolution of the sternum in ornithothoracines. This specimen also provides anatomical information suggesting, like other enantiornithines, *Pengornis* was arboreal. In addition, the specimen potentially preserves the first direct evidence of diet among Jehol enantiornithines: disarticulated fish remains preserved in the slab may suggest *Pengornis* was piscivorous.

Cave Bear from the Paleontological collections of The Museum of Spiš in Spišská Nová Ves (Slovakia)

Zuzana Krempaská[1], Patrícia Mackovjaková[1], Martin Sabol[2]

[1] Museum of Spiš in Spišská Nová Ves, Letná 50, 052 01 Spišská Nová Ves, Slovakia, z.krempaska@gmail.com. prirodovedne@muzeumspisa.com

[2] Department of Geology and Palaeontology, Faculty of Natural Sciences, Comenius University, Mlynská dolina, SK – 84215 Bratislava, Slovakia; sabol@fns.uniba.sk

The fossil remains of cave bears (*Ursus* ex gr. *spelaeus*) from the Slovak territory are known at least since the Middle Ages. To date, their fossil remains are known from at least 60 Slovak caves (Sabol, 2001), although this number could be higher than 100 sites. In the depository of the Museum of Spiš, totally 1333 fossil remains of cave bears are housed from 5 palaeontological sites. These are as follows: Medvedia Cave and Psie diery Cave in the Slovenský raj Mts., Važecká Cave in the Važecký Karst at the contact of Kozie Chrbty Mountains with the Liptovská Basin, Aksamitka Cave in the National Park Pieniny, and Tmavá skala Cave in the Malé Karpaty Mts.

The largest quantity of fossils comes from the Medvedia Cave in the Slovenský raj Mts., where a modern systematic research within the international scientific cooperation with Vienna University and the Austrian Academy of Science were realized in 2007-2009. Based on the preliminary morphometric and palaeogenetic data, the Würmian fossil remains of bears from the site are so far attributed to *Ursus ingressus* (Sabol *et al.*, 2008), a taxon of the Late Pleistocene cave bear spread out mainly over the Central and Eastern Europe. The Museum of Spiš in Spišská Nová Ves obtained from this research into palaeontological collections fund 1,208 incremental numbers, approximately 3000 pieces in 2013.

Sabol, M., 2001. Geographical distribution of Cave Bears (*Ursus spelaeus* Rosenmüller et Heinroth, 1794) in the territory of Slovakia. *Beiträge zur Paläontologie* 26, 133-137.

Sabol, M., Döppes, D., Pacher, M., Rabeder, G., Withalm, G., 2008. Cave bears from the Medvedia jaskyna in the Slovensky raj Mountains (Slovakia): preliminary results. *Stalactite* 58 (2), 74-77.

New insights into the sinus systems of nonmammalian synapsids with the help of neutron tomography

Michael Laaß[1, 2], Eberhard Frey[3], Anders Kaestner[4] and Peter Vontobel[5]

[1]Staatliches Museum für Naturkunde Karlsruhe, Abteilung Geologie (Geological Department), Erbprinzenstr. 13, D-76133 Karlsruhe (Germany), E-Mail: michael.laass@gmx.de
[2]Ruprecht-Karls Universität Heidelberg, Im Neuenheimer Feld 234, D-69120 Heidelberg (Germany), E-Mail: michael.laass@gmx.de
[3]Staatliches Museum für Naturkunde Karlsruhe, Abteilung Geologie (Geological Department), Erbprinzenstr. 13, D- 76133 Karlsruhe (Germany), E-Mail: dinofrey@aol.com
[4]Neutron Imaging and Activation Group, Paul Scherrer Institut, CH-5232 Villigen PSI (Switzerland), E-Mail: anders.kaestner@psi.ch
[5]Neutron Imaging and Activation Group, Paul Scherrer Institut, CH-5232 Villigen PSI (Switzerland), E-Mail: peter.vontobel@psi.ch

The internal cranial anatomy of nonmammalian synapsids is almost completely unexplored, because non-destructive investigation methods were rarely used. Thus, most observations were only made by studying broken or sectioned specimen. As a result, little is known about sinus systems in nonmammalian synapsids. Until now only in Neotherapsids, e.g. anomodonts, therocephalians, gorgonopsians and cynodonts, sinuses in the maxilla were known. In contrast to therocephalians, which possessed at least two maxillary sinuses - an anterior and a posterior one (Sigurdsen 2006) - only one maxillary sinus has been reported for most other Neotherapsids. It has been suggested that the anterior maxillary sinus of therocephalians is homologue to the maxillary sinus of gorgonopsians and the posterior maxillary sinus of therocephalians is homologue to the maxillary sinuses of anomodonts and cynodonts (Sigurdsen 2006).
Our examinations of skulls of the anomdonts *"Cryptocynodon" schroederi, Diictodon feliceps* and *Lystrosaurus* with neutron tomography showed that most anomodonts possessed not only one (posterior) maxillary sinus, but also a small sinus in the anterior part of the maxillae and a large sinus in the premaxilla with a delicate internal structure. The fact that a premaxillary sinus is absent in the basal anomodont *Cryptocynodon* suggests that the premaxillary sinus is a unique feature of anomodonts. Moreover, small taxa such as *Cryptocynodon schroederi* and *Diictodon feliceps* also had widely expanded paratympanic sinus systems in the otic region and the brain capsule, which are an anatomical evidence for large middle ear cavities in these taxa.

Reference:
Sigurdsen, T. 2006. New features of the snout and orbit of a therocephalian therapsid from South Africa. Acta Palaeontologica Polonica 51 (1) 63–75.

Flying dragons and hunting sea monsters – animated 3D models for scientific studies and museum films

Michael Laaß[1, 2], Corinna Hoff[3] and Eberhard Frey[1]

[1]Staatliches Museum für Naturkunde Karlsruhe, Abteilung Geologie (Geological Department), Erbprinzenstr. 13, 76133 Karlsruhe (Germany), E-Mail: michael.laass@gmx.de; dinofrey@aol.com
[2]Ruprecht-Karls-Universität Heidelberg, Im Neuenheimer Feld 234, 69120 Heidelberg (Germany), E-Mail: michael.laass@gmx.de
[3]GONOMETRICS, Kröllwitzer Str. 42, 06120 Halle/Saale (Germany), E-Mail: hoff@gonometrics.de

Since palaeontology exists scientists were keen to reconstruct extinct animals, their locomotion, behaviour and living environment from the fossil record. The earliest reconstructions consisted of simple sketches, paintings or physical models.
Today it is possible to create digital 3D models of extinct animals. These can be generated either by geodetic methods such as photogrammetry and 3D Laserscanning or from tomographic data. Another simple method is to create 3D models using CAD software such as AUTODESK MAYA, CINEMA 4D or Blender. The advantage of this last method is that the 3D models are low-polygon structures, which can easily be handled and animated.
Digital 3D models can not only be used for scientific studies such as morphometric, biomechanical and Finite Element Analyses or mass estimations, but they can also be animated and used for museum films. For the latter it is necessary to create a detailed high-resolution surface of the model, to wrap textures, colours or "hair" on the models surface and to add "bones" for an animation of the model. The animated model can even be integrated in a virtual landscape.
A short overview about the workflow of creating a museum film with animated mesozoic vertebrates such as the pterosaur *Dorygnathus* (Fig. 1) and the plesiosaur "*Mauriciosaurus*" will be given.

Fig. 1. Rendered low-polygon 3D model of the pterosaur *Dorygnathus*

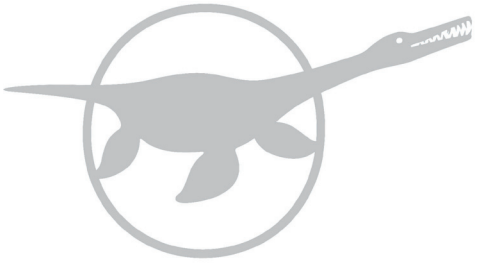
Vertebrate remains from the Kimmeridgian of Villerville-Criqueboeuf (Calvados, Normandy, France) in the collection of Françoise and Jacques Hurtrelle

Yves Lepage

41, rue Edmond Meyer Appt. 464 76620 LE HAVRE, France
Courriel : y.lepage@numericable.com

Discoveries of Kimmeridgian fossils are not uncommon in the Villerville area, but they are always isolated remains from clays or limestones carried to the beach by massive landslides or solifluxion flows. Amateur collectors too often erroneously refer these vertebrate remains, as well as some invertebrates, to the underlying upper Oxfordian Marnes grises de Villerville (Rioult, 1980).
Considerable landslides occurred in this coastal area from the 1980s to the early 1990s and since then the outcrops only show very disturbed beds, which have been fractured and tilted, or have slid and are often obscured by mudflows.
J. Guyader (1968) studied the stratigraphy of the Upper Jurassic of Villerville before these perturbations occurred and made a detailed section. Here, only the lower Kimmeridgian (from the Calcaires coquilliers to the Calcaires à *Harpagodes*) occurs and it is much more condensed than on the northern shore of the Seine estuary at the Cap de la Hève (Seine-Maritime).

Jacques Hurtrelle benefited from similar opportunities a few years later and could record the same beds with great precision. Unaware of Guyader's work, he drew a sketch which is in agreement with the latter's observations, and for about a dozen years he and his wife Françoise conducted regular and methodical prospecting on the small beach at Criqueboeuf whenever the tides allowed it. This small area has yielded hundreds of Late Jurassic and Cretaceous fossils, among which an important series of Kimmeridgian specimens from an old landslide on the foreshore. This locality, which is parallel to the coast and is about 300 m long for a width of a few tens of metres, has yielded abundant vertebrate remains: sauropterygian bones, an ichthyosaur vertebra, bones and teeth of crocodilians, elements of various fishes, and indeterminate bones. This fauna is similar to that from the Cap de la Hève.
This is undoubtedly a unique and homogenous collection, which was carefully collected and is well constrained stratigraphically, like those which were kept in Caen and Le Havre before World War II. Today, its owners wish to make it better known and accessible to researchers interested in studying it. To make this possible, they propose to donate it entirely to the Paléospace in Villers-sur-Mer.



Lindholmemydid turtles (Cryptodira: Testudinoidea) from the Late Cretaceous of Shandong Province, China

Lu Li[1], Haiyan Tong[2,1], Kebai Wang[3], Shuqing Chen[3] and Xing Xu[1]

[1] Key Laboratory of Vertebrate Evolution and Human Origin of Chinese Academy of Sciences, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing , China
[2] Palaeontological Research and Education Centre, Mahasarakham University, Kantarawichai, Mahasarakham 44150, Thailand
[3] Zhucheng Dinosaur Museum , Bureau of Tourism, Zhucheng, Shandong , China

Lindholmemydidae Chkhikvadze, 1975 is a paraphyletic group of basal Testudinoid turtles known exclusively from the Cretaceous and Paleocene of Asia. Although their remains are abundant in some Late Cretaceous and Paleocene localities of Mongolia, the record of lindholmemydids in China is scarce. Two lindholmemydid specimens were discovered recently in the Upper Cretaceous Hongtuya Formation of the Wangshi Group; Kugou locality, Zhucheng, Shandong Province, China. The most complete specimen (ZCDM V0050) is a partial skeleton with incomplete shell associated with a partial skull, complete lower jaw and disarticulated limb bones. On the basis of the strong shell surface ornamentation, the general shape of the carapace and plastron, and the proportion of different plastral elements, ZCDM V0050 represents a new taxon which is closely related to *Mongolemys elegans* from the Upper Cretaceous Nemegt Formation of Mongolia (Khosatzky and Mlynarski, 1971). They form a primitive group of Lindholmemydidae and share three wide inframarginals entirely or almost entirely included in the plastron, absence of a cervical notch, shallow anal notch, short bridge and relatively wide vertebral scutes 2-3. An incomplete shell from the same locality and an isolated costal plate originally described as *Glyptops* sp. from the Wangshi Group of Jingangkou, Laiyang, Shandong Province (Chow, 1954) are referred to as Lindholmemydidae indet.

References

Chow, M.-C. 1954. Cretaceous turtles from Laiyang, Shantung. *Acta Palaeontologica Sinica* **2**, 395-410.
Khosatzky, L. I. & Mlynarski, M. 1971. Chelonians from the Upper Cretaceous of the Gobi Desert, Mongolia. *Acta Palaeontologica Polonica* **25**, 131-144.

‘Mudstone Red in Tooth and Paw’:New finds from the basement of the Jurassic

Jeff Liston[1,2,3,4], Liu Jian-Rong[5], Tom Challands[6], Heinrich Mallison[7], Darren Naish[8], Christian Meyer[9], Feng Zhou[1].

[1] Yunnan Key Laboratory for Palaeobiology, Yunnan University, Cuihu Beilu 2#, Kunming, Yunnan, China, 650091; e-mail: leedsichthys@gmail.com
[2] Department of Natural Sciences, National Museum of Scotland, Old Town, Edinburgh, Chambers Street, Edinburgh, EH1 1JF, Scotland.
[3] School of Earth Sciences, University of Bristol, Wills Memorial Building, Queen’s Road, Bristol, BS8 1RJ, England.
[4] Institute of Biodiversity, Animal Health and Comparative Medicine, College of Medical, Veterinary and Life Sciences, University of Glasgow, University Avenue, Glasgow, G12 8QQ, Scotland.
[5] Lufeng Dinosaurian Museum, Lufeng 651200, Lufeng County, Yunnan Province, China.
[6] School of GeoSciences, The University of Edinburgh, Grant Institute, The King’s Buildings, West Mains Road, Edinburgh EH9 3JW, Scotland.
[7] Museum für Naturkunde Berlin, Berlin, Germany.
[8] Ocean and Earth Science, National Oceanography Centre, Southampton, University of Southampton, Southampton, SO14 3ZH, England.
[9] Naturhistorisches Museum Basel, Augustinergasse 2, CH-4001 Basel, Switzerland.

The Early Jurassic (Hettangian) locality of DaWa Shan was first reported by Yang Zhongjian (‘CC Young’) in 1939. Many decades later, it continues to provide remarkable new discoveries, for example the report at our meeting last year by Stein *et al.* of the presence of embryonic prosauropod remains associated with eggshell fragments. Recently, further discoveries have been made that provide evidence of theropod presence at the same site, in the form of an isolated large tridactyl footprint. Nearby, at another Hettangian locality, recent excavations for a house extension in the village of Qing Liang Shan have also added to our sparse knowledge of Hettangian (Early Jurassic) theropods. Skeletal remains led villagers to alert the Lufeng County Dinosaurian Museum to the find, and the subsequent digging of a trench led to the uncovering of two associated partial prosauropod skeletons. During excavation of these skeletons, shed theropod teeth were found in close proximity to the pelvic girdle of the larger of the two animals.

In terms of the Early Jurassic redbeds of Yunnan Province, their theropod nature is indeed red in tooth and paw.

New discoveries of rodents from the Oligocene and Miocene of the Valley of Lakes (Central Mongolia): biostratigraphic and biogeographic implications

Olivier Maridet[1*], Gudrun Daxner-Höck[1], Demchig Badamgarav [2] & Ursula B. Göhlich[1]

[1] Naturhistorisches Museum Wien, Geologie und Paläontologie Abt., Burgring 7, 1010 Vienna, Austria.
[2] Paleontological Center, Mongolian Academy of Sciences, Ulaanbaatar 210644, P.O. box 767, Mongolia.
*Corresponding author: olivier.maridet@nhm-wien.ac.at

The Valley of Lakes is one of the Pre-Altai depressions in Central Mongolia, which is filled with continental Cretaceous and Cenozoic sediments. Several geological and paleontological research missions were carried out between the 1920s and 2000s in this region, and the Mongolian-Austrian project 2012-2014 (Austrian Science Fund: FWF-P23061-N19) is the last carried out involving comprehensive, multidisciplinary geological and paleontological investigations of the Oligo-Miocene record. Numerous Oligocene and Miocene vertebrate assemblages were collected by bed-by-bed sampling and screen washing along the successive field missions and led to the discovery of more than 280 taxa including gastropods, reptiles, amphibians and an especially abundant and diversified record of mammals (Daxner-Höck, 2007).
The analyses of recently discovered fossils show that rodents underwent remarkable changes from the Early Oligocene to Early Miocene. Here, in the sedimentary sequences of the Hsanda Gol and the Loh Formations, a stratigraphic adjustment is possible based on the evolution of mammals and on the age determinations of intercalated basalts layers (40Ar/39Ar-dating). The local rodent assemblages and evolutionary trends observed in different lineages of rodents can be used as a reference for the biochronology at the scale of Northern Asia. Furthermore, a comparison with Europe shows a progressive biogeographic differentiation along the course of the Oligocene and the Early Miocene, until the late Early Miocene when new biogeographic affinities appear, and consequently new exchanges between Northern Asia and Europe occur.

Reference

Daxner-Höck G. (Ed). 2007. Oligocene-Miocene vertabrates from the Valley of lakes (Central Mongolia): Morphology, phylogenetic and stratigraphic implciations. Annalen des Naturhistorischen Museum in Wien, 108A, 312p.

A year in lissamphibian origins

David Marjanović

Museum für Naturkunde (Leibniz-Institut für Evolutions- und Biodiversitätsforschung), Berlin

The origin of the modern amphibians – frogs/toads, salamanders/newts, caecilians, and the extinct albanerpetontids – is an increasingly hot topic. Phylogenetic analyses pile up, fossils are redes-cribed, new techniques are used, and insights come from unexpected places.

Maddin *et al.* (2012) found the Early Permian amphibamid temnospondyl *Gerobatrachus* to be a lissamphibian. Lissamphibia came out nested within the remaining amphibamids. This caused Jason Anderson to change his mind from the "polyphyly hypothesis" to the "temnospondyl hypo-thesis" on lissamphibian origins. However, suggested corrections to an earlier version of the matrix (Marjanović & Laurin 2009; Sigurdsen & Green 2011) were not taken into account.

Werneburg (2012) redescribed the famous amphibamid (incl. branchiosaurid) and trematopid temnospondyls from the Late Carboniferous site of Nýřany (Czech Rep.) in a monograph.

Usually, only the outer surface of a fossil can yield information for phylogenetics, and even that only to the extent that it has been prepared out of the rock. Computed microtomography (μCT) is changing this. Maddin & Anderson (2012) scanned a large number of extant caecilians and found many phylogenetically informative characters in the braincase; Maddin *et al.* (2012) then extended this to the Early Jurassic stem-caecilian *Eocaecilia*. Salamanders and some lepospondyls are next.

Marjanović & Laurin (in press) will provide an update on the lissamphibian timetree.

The latest, and very large, review paper on these subjects is Marjanović & Laurin (2013).

With Florian Witzmann, I am currently working on a peramorphic Oligocene newt and its implications for heterochrony in lissamphibian origins – among other things.

Maddin HC, Anderson JS (2012). Evolution of the amphibian ear with implications for lissamphibian phylogeny: insight gained from the caecilian inner ear. *Fieldiana Life Earth Sci.* **5**: 59–76.

Maddin HC, Jenkins FA Jr, Anderson JS (2012). The braincase of *Eocaecilia micropodia* (Lissamphibia, Gymno-phiona) and the origin of caecilians. *PLoS ONE* **7**: e50743.

Marjanović D, Laurin M (2009). The origin(s) of modern amphibians: a commentary. *Evol. Biol.* **36**: 336–338.

Marjanović D, Laurin M (2013). The origin(s) of extant amphibians: a review with emphasis on the "lepospondyl hypothesis". *Geodiversitas* **35**: 207–272.

Marjanović D, Laurin M (in press). An updated palaeontological timetree of lissamphibians, with comments on the anatomy of Jurassic crown-group salamanders (Urodela). *Hist. Biol.*

Sigurdsen T, Green DM (2011). The origin of modern amphibians: a re-evaluation. *Zool. J. Linn. Soc.* **162**: 457–469.

Werneburg R (2012). Dissorophoide Amphibien aus dem Westphalian [sic] D (Ober-Karbon) von Nýřany in Böhmen (Tschechische Republik) – der Schlüssel zum Verständnis der frühen ‚Branchiosaurier'. *Semana – Naturw. Veröff. Nat.-hist. Mus. Schloss Bertholdsburg, Schleusingen* **27**: 3–50.

The giant Pleistocene camel from El Kowm, Syria

Pietro Martini[1, 2], Loïc Costeur[2], Jean-Marie Le Tensorer[1], Peter Schmid[1,3]

[1] Institut für Prähistorische und Naturwissenschaftliche Archäologie, University of Basel, Spalenring 145, 4055 Basel, Switzerland.
[2]. Naturhistorisches Museum Basel, Augustinergasse 2, 4001 Basel, Switzerland.
[3]. Evolutionary Science Institute, University of the Witwatersrand, Private Bag 3, Wits 2050, South Africa.
E-mail addresses: pietro.martini@unibas.ch, loic.costeur@bs.ch, Jean-Mari.Letensorer@unibas.ch, smidi@aim.uzh.ch

Camelids originated in North America in the middle Eocene. They diversified there until their dispersal to Eurasia during the latest Miocene (~6 Ma). *Paracamelus* was the first Old World genus and may have given rise to the extant genus *Camelus*. The evolution and taxonomy of camelids in the Old World is poorly known and is based on scarce material. Several fossil species of *Camelus* and *Paracamelus* are recognized, including the middle and late Pleistocene *C. knoblochi* from northern Eurasia and the middle Pleistocene *C. thomasi* from northern Africa. Both were larger than recent camels. The El Kowm Basin (Central Syria, Middle East) is rich in Palaeolithic archaeological sites which also provided abundant mammalian fossils. The complete sequence is dated to early to late Pleistocene (approximately 1.5-1.8 Ma to 50 ka). Within faunal remains, camelids are the most frequent elements, and are probably represented by several undescribed species (pers. obs.). Therefore, this region provides a good opportunity to study the diversity and phylogenetic relationships of Eurasian camels. Here we report the discovery of a large-sized camel from the Mousterian layers (late Middle and Late Pleistocene) in the site of Hummal (El Kowm Basin). It coexisted with modern-looking, smaller-sized camels. Since the morphological differences between the two extant species (*Camelus bactrianus* and *Camelus dromedarius*) are not well known, a large set of cranial and postcranial measurements was collected and used as a comparative basis to study the fossils. The large size and peculiar morphology of the bones in carpal and tarsal articulations clearly differentiate this camel from the extant ones. In particular, the hamate was broad, the malleolar bone was elongated, and the distal tibia had a unique configuration. The limb articulation bones are overall 30% larger than in the extant species, suggesting that total body mass would have been double. Comparison to fossil forms, especially to *C. knoblochi* and *C. thomasi*, is still needed but first observations tend to indicate that the Syrian camel represents a new species.

A reassessment of the first Late Jurassic megatracksite in Northern Switzerland

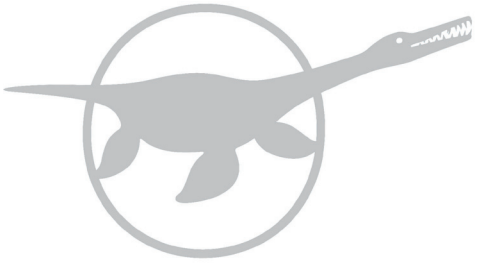
Christian A. Meyer[1], Basil Thüring[1] & Daniel Marty[1,2]

[1]Naturhistorisches Museum Basel, Augustinergasse 2, CH-4001 Basel, Switzerland. E-mail:christian.meyer@bs.ch

[2] Office de la Culture, Section d'archéologie et paléontologie, Paléontologie A16, Hôtel des Halles, C.P. 64, 2900 Porrentruy 2, Switzerland

Since the discovery of the Lommiswil quarry tracksite in 1989 more than 30 sites have been recognized in the Late Jurassic Reuchenette Formation of N Switzerland. They cover a chronostratigraphic range from the middle Early Kimmeridgian to the late Late Kimmerdigian and can be attributed to more than 8 major track-bearing intervals, some of which yield up to 15 distinct track-bearing levels. The stratigraphically youngest track interval corresponds to the first recognized megatracksite in Europe, and is located at the base of the Solothurn Turtle Limestone Member or some meters below and includes the Lommiswil and 15 other tracksites. This interval is characterized by abundant large sauropod tracks, and so far has only revealed one single track of a medium-sized theropod. Here we report on new discoveries that can be attributed to this megatracksite. Several additional surfaces below and above the main track level have meanwhile been found at Lommiswil and close-by. One yields undertracks only, whereas another exhibits isolated pes tracks of sauropods that are up to 1.5 m in length. Furthermore, at the Grenchenberg, a trackway of a large theropod was discovered within this interval. This 3 m long trackway consists of four consecutive tracks with a mean length of 35 cm and a slightly-curved digit III. We compare it with the slightly older (early Late Kimmeridgian) large sample of theropod tracks from the Highway A16 tracksites near Porrentruy (Canton Jura), where theropod tracks of at least 3 different morphotypes and size classes are clearly more common than sauropod tracks. The Grenchenberg trackway is similar to the "robust morphotype" including the largest tracks of Highway A16 with a pes length of up to 80 cm.

The skeletal record of theropods is rather scarce in the Late Jurassic of N Switzerland. Nonetheless, two teeth of small theropods (probably dromaeosaurids) from the Solothurn Turtle Limestone, an allosaurid tooth from the Late Oxfordian of Röschenz, and a large tooth of Ceratosaurus from the late Early Kimmeridgian of Moutier are known. Both the ichnological and skeletal record indicate the presence of at least five different theropod taxa. This together with the sauropod track and bone record is good evidence that the dinosaur community on the Jura carbonate platform was recurrent and more diverse than previously assumed.



New material of *Pseudoloris* (Omomyidae, Primates) from Sant Cugat de Gavadons (Late Eocene, Iberian Peninsula)

Raef Minwer-Barakat[1], Judit Marigó[1], Salvador Moyà-Solà[2]

[1]Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, 08193 Cerdanyola del Vallès, Barcelona, Spain; raef.minwer@icp.cat, judit.marigo@icp.cat
[2]ICREA at the Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, 08193 Cerdanyola del Vallès, Barcelona, Spain; salvador.moya@icp.cat

The study of Eocene primates in the Iberian Peninsula has received a great deal of attention during recent decades, mainly due to the existence of continuous and well-exposed continental sections from this epoch, which contain abundant vertebrate remains. Recent studies carried out by the Institut Català de Paleontologia Miquel Crusafont (ICP) research team have focused, among others, on the populations of the genus *Pseudoloris* (Microchoerinae, Omomyidae, Primates) from Eocene Spanish localities including Sant Jaume de Frontanyà and Mazaterón.

Here we report new undescribed material of *Pseudoloris* from Sant Cugat de Gavadons, a Late Eocene (MP19, Headonian) locality from the Ebro Basin (Iberian Peninsula). The material includes a C1, an M1, an M2, and a fragment corresponding to the trigonid of another M1 recently found in the collections of the Naturhistorisches Museum Basel (Switzerland), which probably arrived in Basel as a result of the long-term collaboration between Dr. Crusafont-Pairó and several Swiss paleontologists, and a P3 from the collections of the ICP. The species *Pseudoloris reguanti* was described by Crusafont-Pairó in 1967, based on a single lower molar from Sant Cugat de Gavadons. Sometime later, the holotype and unique material of *P. reguanti* was lost from the collections of the ICP. According to the description of Crusafont-Pairó, the complete M1 found in Basel, larger than those of all the described species of *Pseudoloris*, may correspond to the holotype. Nevertheless, this statement cannot be proved due to the lack of illustrations accompanying the original definition of the species. Probably, the detailed study of this material will allow us to designate a neotype for *P. reguanti* and to provide proper descriptions, measurements and illustrations of the available specimens, as well as an emended diagnosis for this species.

Tail evolution in early birds: soft tissue and skeletal evidence from the Jehol*

Jingmai K. O'Connor

Key Laboratory of Vertebrate Evolution and Human Origin of the Chinese Academy of Sciences, Institute of Vertebrate Palaeontology and Paleoanthropology, Chinese Academy of Sciences, Beijing 100044, China

Avian tail feathers are extraordinarily diverse (e.g. peacock, birds-of-paradise, vs. pigeon), having been modified for functions beyond flight itself – the display tail morphologies of some sexually dimorphic birds is the quintessential example of sexually driven natural selection (producing costly structures). The modern avian 'tail' is a derived independent unit formed by the pygostyle and bulbi rectricium that allows for fine tuned manipulations of the rectrices, which facilitates flight in a diversity of functions, particularly during turning and slow flight. The reduction of the elongate boney tail (and evolution of the pygostyle) is one of the most obvious evolutionary changes to occur in Aves, however the fossil record does little to elucidate this morphological transition. Although no transitional taxa are known, exceptional preservation in the Early Cretaceous Jehol Group allows the evolution of the tail to be studied from the soft tissue integument. Here we discuss the tail plumage of Early Cretaceous birds in context of the skeletal morphology. The evolutionary history of the avian tail was more complex than a frond to fan; evidence suggests evolution was not unidirectional and that as in living birds, the tail served multiple functions. Tail feathers are diverse but aerodynamic rectricial patterns are nearly entirely limited to Sapeornithiformes and Ornithuromorpha, thus the appearance of an anatomically 'modern' pygostyle and aerodynamic rectricial patterns coincide, and occurred multiple times within Aves. Basal birds show evidence that, like living taxa, they evolved cost-reducing structures to accommodate their ornaments. The degree of ornamentation among basal birds suggests sexual dimorphism and polygamous lifestyles.

*For consideration in the SAPE session

A partial skull of *Hungarosaurus* from the Late Cretaceous of Hungary: implications for ankylosaur locomotion

Attila Ősi[1*], Xabier Pereda Suberbiola[2], Tamás Földes[3]

[1]Hungarian Academy of Sciences – Eötvös Loránd University, Lendület Dinosaur Research Group, Pázmány Péter sétány 1/c, Budapest, 1117, Hungary.

[2] Universidad del País Vasco/Euskal Herriko Unibertsitatea, Facultad de Ciencia y Tecnología Dpto. Estratigrafía y Paleontología Apartado 644, 48080 Bilbao, Spain

[3]Institute of Diagnostic Imaging and Radiation Oncology of the University of Kaposvár, Kaposvár, 7400 Guba S. 40., Hungary

An ankylosaur partial skull collected from the Upper Cretaceous (Santonian) Csehbánya Formation in Iharkút, western Hungary, and the endocranial cast taken from the brain cavity are presented here. The basicranium is the only known, common cranial element in all European Late Cretaceous ankylosaurs (except in *Struthiosaurus languedocensis*) that can help to make a detailed comparison of the different taxa. Although there is evidence for the sympatry of two ankylosaur taxa in Iharkút, the morphology of the exoccipital, the elongated „neck" region of the basioccipital, the shape of the occipital condyle, and the different flexure of the medulla relative to the forebrain unambiguously differentiate this specimen from the basicrania of *Struthiosaurus austriacus* and *Struthiosaurus transylvanicus*, and suggest its affinity with *Hungarosaurus*. Whereas the endocranial cast reflects a brain generally similar to those of other ankylosaurs (i.e. *Struthiosaurus*, *Panoplosaurus*, *Polacanthus*), the dorsally hypertrophied cerebellum (also present is *Struthiosaurus transylvanicus*) is quite unusual within the group suggesting a more sophisticated cerebral coordination of posture and movement, and perhaps a more cursorial habit than it is expected in other ankylosaurs.

The fossil birds from the Late Miocene of Piemonte (NW Italy)

Marco Pavia, Simone Colombero, Piero Giuntelli, Giulio Pavia

Dipartimento di Scienze della Terra, Museo di Geologia e Paleontologia, Università degli Studi di Torino, Via Valperga Caluso, 35 I-10125 Torino ITALY email marco.pavia@unito.it

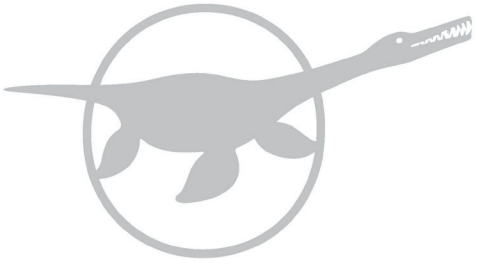
Fossil vertebrates from Late Miocene continental deposits of Italy are reported from different localities and isolated bones of mammals and reptiles mostly represent them. From these localities fossil birds are reported only occasionally and never studied in detail. The only exception is the fossil bird association found in the fissure fillings of the Gargano area, where the fossil birds testifying an insular avian community, are very common.

In the recent years two Late Messinian fossil localities very rich in vertebrate remains have been found in the Piemonte area, one near the village of Moncucco Torinese (Asti) and the other near the village of Verduno (Cuneo). In the continental sediments of the "Conglomerati di Cassano Spinola" Formation outcropping in these two localities, a rich fossil vertebrate association has been found including, in addition to birds, large and small mammals, reptiles, amphibians and fishes.

The fossil remains are normally fragmented and the fossil birds are the less abundant among the whole assemblage. However the fossil bird remains testify a quite differentiate association represented by at least 15 taxa of Anatidae, Phasianidae of at least two species, Accipitridae, Strigidae, Picidae and different species of Passeriformes.

In addition to these new findings it is worth mentioning an already published diving duck (*Aythya* sp) from the Messinian lacustrine layers of Cherasco (CN) and an undescribed Accipitridae from the Messinian of Roddi d'Alba (CN).

The knowledge of the avifauna of the Late Miocene of Piemonte will contribute, together with the information given by the other vertebrates and the comparison with coeval bird associations, to evaluate the significance of the whole fossil association from a biogeographical and ecological point of view.



Morphology and variability of the meta- and acropodium in *Protoceratops andrewsi* (Dinosauria, Ceratopsia)

Andrey V. Podlesnov

Paleontological Institute, Russian Academy of Sciences, Moscow, Russia.
Email: darkforest89@rambler.ru

Structural patterns of the metapodial and acropodial elements in 4 specimens of the hind limb of *Protoceratops andrewsi* (juvenile and young adult females, young adult and old males) have been studied. The following differences demonstrated by them can be interpreted in the light of both age and gender variation.

(1) In the juvenile individual the metatarsals are consolidated and show successive overlap starting from the Ist one. In the young adults (both female and male) this condition is retained for most length of the bones, but there is a slight divergence between distal parts of the Mt III and Mt IV. Lastly, in an old individual the zone of overlap embraces only the most proximal portion of the metatarsals, while distally they diverge like a fan.

(2) An increase in concavity of lateral contour of the Mt IV proceeds from juveniles to young adults. It is most expressed in the young adult male but seen to be weakened in the old adult.

(3) The proximal parts of metatarsals undergo expansion from the juveniles to young adults and than to the old adult.

(4) On transition from the younger to old adults, the elements of meta- and acropodium show dorsoventral flattening, most markedly expressed in the proximal portions of the metatarsals.

(5) In young animals the Mt III is slightly shorter than the corresponding finger, while in the old individuals the condition is reverse.

(6) During ontogeny, observed is a notable change in design of the terminal phalanges. In a juvenile they are triangle-shaped, slightly tapered, with only gently rounded sides. With age, the terminal phalanges of the middle (supporting) toes are transformed into "protohoof"-like structures, which become shorter, broadly rounded distally and develop the side outgrowths.

(7) Some differences in the metapodia of young adult individuals may be caused by the sexual dimorphism. These relate to the proximal portion of the Mt IV which, in female, is narrower and more gently curved laterally in comparison with that of male.

Hence, the growth changes in *Protoceratops andrewsi* refer to the distal divergence of the metatarsals, the broadening of their proximal portions, an increase in curvature of the Mt IV, general flattening the meta- and acropodia, and the remodeling of structure of the terminal phalanges. Evidently, with age, the hind limb underwent expansion and flattening, which probably made it more steady on the soft ground, at the cost of the ability to run.

The presence of *Anancus arvernensis* and *Mammut borsoni* around Veleni, Dolj County, South-West of Romania

Aurelian Popescu

Muzeul Olteniei Craiova

Veleni locality is situated in the South-West of Romania, in Dolj County, at 40 km west of Craiova, the capital of the county. It is part of Seaca de Pădure village together with two other villages and it is located on a plateau with an average height of 240 m, fragmentized by not too deep valleys, with west-east direction.
The village territory belongs to the Moesian Platform. Since 1931, several dental pieces attributed to some mastodons' species were found in the sand and ballast pits located close to the village.

The Mandible of *Mammut borsoni*, registry no. 1468/11406
It was discovered in a pit, in 1931. Shortly after the discovery it was restored in Bucharest.
The original material preserves the full dentition, the left lower maxillary bone until mid m1 and right lower maxillary bone, except the lingual conulid (bord lingual) near the molars m2-m3. Alexeeva & Firu (1962) gathered the biometric data and formulated some considerations on the studied piece belonging to a late form of *Mammut borsoni*.

M3dex of *Mammut borsoni* registry no. 2296/30079
Discovered at the Veleni ballast pit in July 1965, the molar is trapezoidal, with the small ramus at the back side. The occlusal surface is well marked near the lower molar at the anterior side.

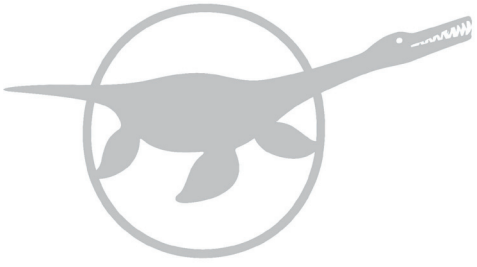
M2sin of *Anancus arvernensis*
The molar was discovered by Mircea Stanciu, a student, on the left side of the Rangu valley, in the place called Fântâna lui Lele, about 40 years ago, and Mr. Popa R. Ion, a retired teacher, brought it to the museum on January 13, 2011.
The molar was reconstituted from two fragments, after having been found cut transversally in half.

Histology of pterosaur mandibular symphyses from Hungary: An ontogenetic series?

Edina Prondvai [1], Emese R. Bodor [2], Attila Ősi [1]

[1] Hungarian Academy of Sciences – Eötvös Loránd University "Lendület" Dinosaur Research Group, Eötvös Loránd University, Budapest, Hungary
[2] Hungarian Geological and Geophysical Institute, Geological and Geophysical Collections, Budapest, Hungary

The holotype of *Bakonydraco galaczi*, a medium-sized azhdarchid pterosaur described from the Late Cretaceous (Santonian) vertebrate locality of western Hungary (Iharkút, Bakony Mountains) is an exceptional, three-dimensionally preserved, complete lower jaw. Over several years of excavation, 56 additional mandibular symphyseal fragments have been recovered that, apart from possible size differences, look virtually identical with the symphysis of the holotype mandible. Thus, the Hungarian azhdarchid material has been considered one of the most extensive monospecific pterosaur assemblages in Europe. Covering a wide size range, these elements have been thought to represent a developmental series of *Bakonydraco galaczi* making them ideal to test whether absolute size and/or morphology are reliable indicators of relative ontogenetic stages in this pterosaur. For that, we selected 45 specimens for multivariate morphometric analysis and classified them into four different size groups. After acquiring the morphometric dataset, eight symphyses representing each size group were chosen for histological thin sectioning. Based on qualitative histological evaluation, these specimens were assigned to relative ontogenetic stages prior to quantitative histological analysis. Microstructural characters suggestive of developmental state were then quantified for intra- and interindividual uni- and multivariate analyses to test the correspondence between the results of qualitative and quantitative histology and morphometrics. In contrast to our expectations, histological results suggest that the smallest specimen was a subadult individual and not an early juvenile. Substantial size difference revealed between this specimen and others of corresponding histological maturity implies the presence of at least two pterosaur taxa. The argument against the monospecific origin of this pterosaur assemblage is further supported by the results of multivariate morphometric analyses which clearly separated the smallest symphyses from the rest of the specimens, whereas the latter formed one continuous group. Although considerable size variability of corresponding ontogenetic stages was evident in the latter group too, it is highly unlikely that this group of specimens is also composed of more than one pterosaur species. Instead, this observation indicates high intraspecific variability in adult body sizes and renders size in itself a very poor indicator of skeletal development in these animals.



Evolutionary history of hoofed mammals during the Oligocene-Miocene transition in Western Europe

Laureline Scherler[1], Bastien Mennecart[2], Florent Hiard[2], Damien Becker[3], and Jean-Pierre Berger[2†]

[1] Paléontologie A16, Office cantonal de la culture, République et canton du Jura, Hôtel des Halles, CH-2900 Porrentruy; laureline.scherler(at)net2000.ch

[2] Département des Géosciences, Université de Fribourg, chemin du Musée 6, CH-1700 Fribourg

[3] Musée jurassien des sciences naturelles, route de Fontenais 21, CH-2900 Porrentruy

The biostratigraphy and diversity patterns of terrestrial, hoofed mammals help to understand the Oligocene-Miocene transition in Western Europe. Three phases are highlighted: 1) the beginning of the Arvernian (Late Oligocene, MP25-27) was characterised by a "stable" faunal composition including the last occurrences of taxa inherited from the Grande Coupure and of newly emerged ones; 2) the latest Arvernian (Late Oligocene, MP28-30) and the Agenian (Early Miocene, MN1-2) saw gradual immigrations leading to progressive replacement of the Arvernian, hoofed mammals towards the establishment of the "classical" Agenian fauna; 3) the beginning of the Orleanian (Early Miocene, MN3-4) coincided with the African-Eurasian faunal interchanges of the Proboscidean Datum Events and led to complete renewal of the Agenian taxa and total disappearance of the last Oligocene survivors. Faunal balances, poly-cohorts and particularly cluster analyses emphasise these three periods and define temporally a well-framed transition between MP28 and MN2. This transition started in MP28 with a major immigration event, linked to the arrival in Europe of new ungulate taxa, particularly the anthracothere *Microbunodon*, the cainothere *Cainotherium*, and the rhinoceros *Mesaceratherium*. This step was followed by a phase of regional speciation and diversification (MN1-2). The Oligocene-Miocene faunal transition as we consider it here ended right before the two-phased turnover linked to the Proboscidean Datum Events (*Brachyodus*- and Creodont-Events, MN3-4). Additionally, locomotion types of rhinocerotids and ruminants provide new data on the evolution of environments during the Oligocene-Miocene transition.

Finite element analysis of the cingulate lower jaw

Sílvia Serrano-Fochs[1], Soledad De Esteban-Trivigno[1,2], Jordi Marcé-Nogué[3], Josep Fortuny[1], Richard Fariña[4]

[1] Institut Català de Paleontologia, Cerdanyola del Valles, Catalonia, Spain; serranofsilvia@gmail.com, josep.fortuny@icp.cat.
[2] Transmitting Science, Piera, Spain; soledad.esteban@transmittingscience.org.
[3] Universitat Politecnica de Catalunya, Terrassa, Catalonia, Spain; jordi.marce@upc.edu
[4] Universidad de La República, Montevideo, Uruguay; dogor@netgate.com.uy.

Finite element analysis (FEA) allows simulating the biomechanical behavior of biological structures, in order to understand how they react under different loads. This technique has been shown very useful in paleontology, as it allow researchers to test their functional hypothesis.

The mammalian order Xenarthra comprises a group of peculiar placental mammals forming a monophyletic group with highly heterogeneous morphology. It includes the suborders Cingulata and Pilosa, comprising the extant anteaters, armadillos and tree sloths. The aim of this work is to evaluate the biomechanical capabilities of the Cingulate lower jaw in a comparative framework, and to test if there are a relationship between diets and the stress pattern of the mandibles. To achieve this, FEA on planar models of the lower jaw of 14 Cingulate species (three of them extinct) have been developed. The hypothesis proposed is that, for equivalent forces, species with diet requiring less processing (e.g. insects) would display a lower jaw showing a higher stress level than species with more processing requirements (e.g. herbivorous).

Omnivores and herbivorous species, as predicted by the hypothesis, show lower levels of stress than most insectivores. However, some insectivores display a stress pattern more similar to omnivores, which is probably due to the limited information about its natural history. On the other hand, *D. novemcinctus*, display a relatively weak lower jaw, in clear disagreement with the variety of items ingested by this species. This suggests that other mechanisms different than mastication may be involved in the food processing of this species.

The results support the use of FEA for functional analysis, showing it as a really valuable tool in paleobiology. However, “Evolution is a tinkerer”, and sometimes it may find alternative solutions to develop certain functions, not related with the structure analyzed, as in *D. novemcinctus* case.

Tupilakosaurid amphibians (Temnospondyli) and interrelationships of the Trimerorhachomorpha

Mikhail A. Shishkin

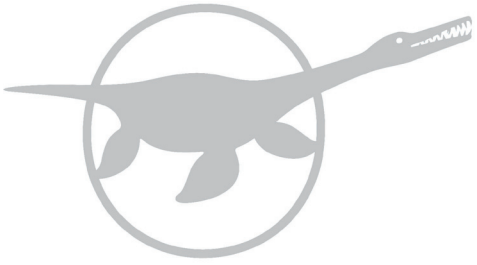
Paleontological Institute, Russian Academy of Sciences, Moscow, Russia.
E-mails: schsz@orc.ru; shishkin@paleo.ru

The Early Scythian tupilakosaurids belong to the Trimerorhachomorpha ("Dvinosauria"), along with the Paleozoic Trimerorhachidae, Eobrachyopidae, Dvinosauridae and, following author's concept, the Mesozoic Brachyopidae and Metoposauridae (Shishkin 1973, 2011). The last two families are often placed in the "stereospondyl clade", which is here regarded as a junction of the archegosauroid–capitosauroid radiation with a number of unrelated families.

Current opinion tends to regard the tupilakosaurids as a sister group of the Dvinosauridae and to unite the both with the Eobrachyopidae in a common clade, Dvinosauroidea (Yates, Warren, 2000). But what is called the synapomorphies of this clade are either the traits shared by all the short-faced (brachyopid-designed) trimerorhachomorphs or those listed erroneously. In particular, the alleged shared loss of the lacrimal and presence of lateral exposure of the palatine (LEP) do not occur in dvinosaurids. This family is actually a relict of the Trimerorhachidae combinining its archaic characters with some novelties of purely paedomorphic or grade nature. By contrast, in tupilakosaurids the paedomorphic trends are accompanied by specific remodeling of the skull design mostly affecting the basicranial area and palatolacrimal complex.

An idea of proximity of the Tupilakosauridae to the Eobrachyopidae may be largely supported on the following grounds. In both groups the palatal pterygoid branch retains only short contact with the palatine. But the most notable similarity is the expansion of the palatine ossification onto the orbital margin. In eobrachyopids this portion of bone is believed to border a true lacrimal and so considered as a projection of the palatine itself (LEP, see above). On the other hand, in tupilakosaurids the separate lacrimal is lacking, and the ossification in question is referred to as the compound palatolacrimal. The problem of homology of the "LEP area" in these cases may be crucial for assessment of true relationships. One of possibilities is that this character evolved in the two families independently and not quite uniformly.

The closest resemblance in possessing the palatolacrimal may further support the idea of direct relationship between the tupilakosaurids and the Laurasian brachyopid *Batrachosuchoides* (cf. Milner, 1990). The condition they exhibit seems to be in contrast with that in true (Gondwanan) brachyopids, which are reported to lack any kind of the "lacrimal-looking" structure. The same is the case for the Laurasian brachyopid *Hadrokkosaurus* ("*Vigilius*"), whose morphology suggests its derivation from the dvinosaurids. All this warrants the conclusion that the brachyopid-designed Mesozoic trimerorhachomorphs represent in fact a number of separate lineages, of which only the one could be directly linked with the Tupilakosauridae.

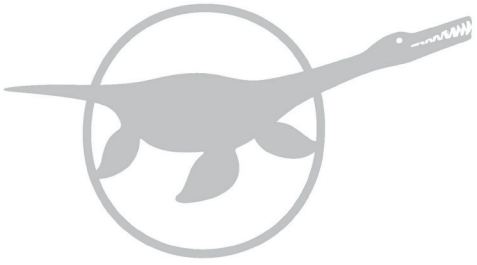


The evolution of sauropodomorph long bone histology revisited: Long bone histology of a "prosauropod" (Dinosauria: Sauropodomorpha) from the Late Triassic of Normandy and a comparison with some large bone shafts from the Late Triassic Aust Cliff near Bristol (England).

Koen Stein[1*], Eric Buffetaut[2], P. Martin Sander[1]

[1]Steinmann Institut für Geologie, Mineralogie und Paläontologie, University of Bonn, Germany
[2]CNRS (UMR 8538), Laboratoire de Géologie de l'Ecole Normale Supérieure, Paris, France
[*]Correspondence: koen_stein@yahoo.co.uk

Sauropods were the largest terrestrial animals that ever lived. They evolved from medium and small sized sauropodomorphs that lived during the Triassic and Early Jurassic. During this phyletic size increase, some noteworthy changes in long bone histology take place. The long bones of small basal sauropodomorphs (e.g. *Saturnalia, Thecodontosaurus*) show well vascularized tissues with mostly longitudinal vascular orientation. Long bones of medium-sized sauropodomorph taxa (e.g. *Plateosaurus*) also show longitudinal vascular orientation, but with more circumferential anastomoses than small taxa. In basal sauropods (e.g. *Isanosaurus*), and most crown sauropods, a fully circumferential vascular architecture, called laminar or plexiform bone, can be observed. Laminar or plexiform bone is found in other large dinosaurs, but also in therapsids and mammals, suggesting that this trend of increasing laminarity in Sauropodomorpha is most likely correlated with an evolutionary increase in body size, the evolution of obligate quadrupedality and a pillar-erect stance. New results from bone histology of a large "prosauropod" (aff. *Camelotia*) from the Late Triassic (late Norian or Rhaetian) of Normandy (La Pernelle, Manche), presented here for the first time, further support this hypothesis. The specimen is a poorly preserved femur found in the La Pernelle conglomerate and was core drilled on the anterior side. Remarkably, some areas in the bone preserved well enough to observe histological features. The general histology of the Normandy "prosauropod" is reminiscent of that of *Plateosaurus*, with a mostly circumferential organization of vascular canals and few longitudinal anastomoses. However, less longitudinal and radial anastomoses are present than in *Plateosaurus*. Well developed primary osteons with narrow lumen, as well as the presence of secondary osteons indicate the specimen was relatively mature (*cf*. sauropod HOS 9/10). Large bone shafts from the Rhaetian bone bed (Westbury Formation, Penarth Group) at Aust Cliff near Bristol were previsouly interpreted as "prosauropod" long bones. However, their histology shows a peculiar, longitudinal vascular pattern, with the development of secondary osteons inside the longitudinal primary ones. The histology of the Aust Cliff material is thus inconsistent with the Normandy "prosauropod", and their affinity remains equivocal at best.



Fishes from the Aral Formation of Central Kazakhstan

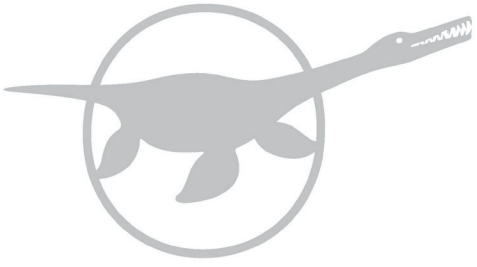
Eugenia K. Sytchevskaya

Palaeontological Institute, Russian Academy of Scienses, Moscow, Russia
e-mail:eks@paleo.ru

The Cenozoic Aral Formation of Western Kazakhstan contains a rich vertebrate assemblage whose age is still open to debate despite continuous study starting from 30ies of the last century (Argyropulo, 1939). On the evidence from mammalian microfauna, this unit is dated as either the Late Oligocene (Bendukidze, De Bruijn, Hoek Ostende, 2009) or Early Miocene (Aquitanian, Zone MNU 1, see Lopatin, 2004).

During the Aral epoch, the freshwater basins of eastern coast of the Eastern Paratethys (Cis-Aralian area, Altyn-Chokussy and Thunguruk-sor localities) were inhabited by a rather diverse fish community which included *Acipenser sp*. (Acipenseridae), *Esox aralensis* Sytch. (Esocidae), *Rutilus tungurukensis* Sytch., *R.* cf. *frisii* (Nordm.), *Palaeoleuciscus* sp., *Protothymallus*? sp., *Proaspius* sp., *Tarsichthys* sp., Abramidini gen. ind. (Cyprinidae), *Silurus* sp. (Siluridae); *Perca* sp., *Leobergia* sp., Percidae gen. ind. (Percidae). In terms of abundance, the assemblage was markedly dominated by cyprinids and percids. Notable is the presence of genera shared with the Oligocene-Miocene ichthyofaunas of Bohemia, such as *Esox*, *Tarsichthys*, *Palaeoleuciscus*, *Protothymallus,* or with those from Late Oligocene(?) – earliest Miocene of Western Siberia (*Acipenser*, *Esox*, *Rutilus*, *Abramidini* gen. ind., *Silurus, Leobergia*). The core of the Aral community was formed by the Eurosiberian elements that co-existed with some endemics of Inner Asia (*Proaspius* sp.). This enables one to assess the assemblage as biogeographically transitional between the Eurosiberian and Inner Asian ichthyofaunas.

The Cis-Aralian fish assemblages characterizing the Aral epoch and immediately succeeding time span, primarily those known from the Altyn-Chokussy and Mynsualmas localities (Aral Formation and Middle Burdigalian MN 4, respectively), reflect the mosaic of settings that controlled the ecology of coeval inhabitants of the freshwater coastal basins in the Eastern Paratethys. It was a time when there was started the formation of ecological types that came to dominate during the Neogene and later became inherited by the recent ichthyofaunas of this area. Some particular aspects of this initial event seem to include the spreading of a few marine invaders (such as herrings of the genus *Alosa*) into the coastal lakes and river mouths. And conversely, most likely at the same time there have been arisen the cyprinid ecotypes close to the extant *Rutilus frisii*, which, first in a course of seasonal feeding migrations, got an ability to populate the brackishwater swampy gulfs of the Paratethys.



First steps to the underground world: the Cretaceous lizard *Slavoia*.

Mateusz Tałanda[1] and Marcin Bińkowski[2]

[1]Department of Paleobiology and Evolution, Faculty of Biology, University of Warsaw, Miecznikowa 1, 02-097 Warszawa, Poland; e-mail: m.talanda@student.uw.edu.pl;
[2]X-ray Microtomography Laboratory, Department of Biomedical Computer Systems, Institute of Computer Science, Faculty of Computer and Material Science, University of Silesia, Będzińska 39, Sosnowiec 41-200, Poland

Lizards display a great variety of ecological niches. They adapted to very different habitats, including marine, desert, and arboreal. Underground forms developed in several groups of lizards (i.e. some skinks, dibamids, snakes, amphisbaenians). Many of them are so highly modified that it is hard to determine their relationships with other lizards. They are usually modified in a similar manner, sharing the same adaptations. This led many researchers to believe that they are closely related. In most cases it has been falsified by molecular data. This shows that the burrowing behavior and morphology evolved parallel many times. The Mongolian lizard *Slavoia* from the Late Cretaceous presents the anatomy with a mosaic of primitive and advanced characters. It has reduced orbits and a broad skull roof, which is typical for burrowing lizards. However, it lacks several modifications observed in other underground forms, for example completely reduced temporal arch or enlargement of parietal and braincase. Similarly, the postcranial skeleton has a shortened neck and modified limbs: enlarged forelimbs and reduced hindlimbs; but the trunk is not elongated. This mixture of characters is interpreted as primitive and probably initial for most burrowing lizard lineages (at least in respect to the skull). Thus, *Slavoia* gives unique insight into the early stage of evolution to the burrowing mode of life. I hypothesize on the sequence of evolutionary skull modifications, based on comparison with more or less advanced burrowing lizards. It may help understanding how the highly specialized burrowing morphology evolved from a primitive status and which parts of the skeleton may preserve phylogenetic information.

Dinosaur remains from the Camarillas Formation (lower Barremian) at Galve sub-basin (Teruel, Spain)

Francisco J. Verdú [1], Rafael Royo-Torres[1], Luis Alcalá[1], Francisco Gascó[1]& Alberto Cobos, [1]

[1] Fundación Conjunto Paleontológico de Teruel-Dinópolis, Teruel, Spain; verdu@fundaciondinopolis.org, royo@dinopolis.com, alcala@dinopolis.com, gasco@fundaciondinopolis.org, cobos@dinopolis.com

The fluvial deposits of the Camarillas Formation (lower Barremian) in Teruel province (Spain) bear a great fossiliferous richness in some its levels. Some of the existing sites in these levels have been known since 1958. Therefore, three new dinosaur taxa have been proposed by different research teams for this formation at Galve sub-basin: the ornithopods, *Delapparentia turolensis* and *Gideonmantellia amosanjuanae,* both in Galve; and a ceratosaur, *Camarillasaurus cirugedae,* in Camarillas. The wide range of dinosaur groups also includes sauropods, stegosaurs? (fragmentary remains), maniraptorans and spinosaurids. Apart from dinosaurs, several new species of mammals, a new cryptodiran turtle, a new hybodontid shark and a new unionid bivalve, have also been cited for the lower Barremian of the Camarillas Formation. All these fossils are of great interest for us to have a deeper knowledge about how those ecosystems evolved. Since 2008, the Fundación Conjunto Paleontológico de Teruel-Dinópolis (FCPTD) has discovered and catalogued several sites within the Maestrazgo Geopark boundaries belonging to the Camarillas Formation. In Las Dehesillas site in Aliaga, the FCPTD recovered part of the axial skeleton (one cervical vertebra, several dorsal vertebrae and some ribs) of a hadrosauriform ornithopod. As a result of the weekly preventive paleontological monitoring of SIBELCO Hispania clay mine the FCPTD has kept on finding new sites in Galve. Close collaboration with this company ensured the excavation of classic sites on the mine such as San Cristóbal 1 site, where new fossils of sauropods and ornithopods have been found recently. The FCPTD has also brought to light three new sites, which gather more than 1,000 (cranial and postcranial) anatomical elements from, mainly, ornithopod dinosaurs.

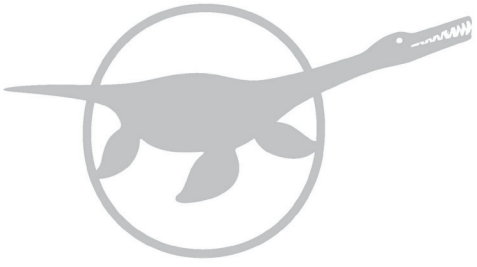
Acknowledgements: SIBELCO Hispania; Departamento Educación, Universidad, Cultura y Deporte, Gobierno de Aragón (projects 092/2008-2013; 037/2013); Fundación Conjunto Paleontológico de Teruel-Dinópolis; FOCONTUR (Grupo de Investigación Consolidado E-62, Departamento de Industria e Innovación, Gobierno de Aragón and Fondo Social Europeo); Ministerio de Ciencia e Innovación/FEDER (project DINOSARAGÓN CGL2009–07792); Ministerio de Educación y Ciencia (AP2008-00846, AP2010-); and Instituto Aragonés de Fomento.

Plesiosaur specimens from the Maastrichtian Phosphates of Morocco

Peggy Vincent[1], Nathalie Bardet[2], Alexandra Houssaye[3], Xabier Pereda Suberbiola[4] and Mbarek Amaghzaz [5]

[1]Staatliches Museum für Naturkunde Rosenstein 1 D-70191 Stuttgart, Germany, pvincent@mnhn/fr
[2]UMR 7207 du CNRS, Département Histoire de la Terre, Muséum National d'Histoire Naturelle, C.P. 38, 8 rue Buffon, 75005 Paris, France, bardet@mnhn.fr
[3]Steinmann Institut für Geologie, Paläontologie und Mineralogie, Universität Bonn, Nussallee 8, 53115 Bonn, Germany, houssaye@uni-bonn.de
[4]Universidad del País Vasco/EHU, Facultad de Ciencia y Tecnología, Departamento de Estratigrafía y Paleontología, Apdo. 644, 48080 Bilbao, Spain,xabier.pereda@ehu.es
[5] Office Chérifien des Phosphates, Centre minier de Khouribga, Maroc

Several clades of marine tetrapods, including the apex predators mosasaurs and plesiosaurs, disappeared during the mass extinction at the end of the Cretaceous, about 66 My ago. The extreme fossil richness of the Maastrichtian Phosphates of Morocco provides insights into the systematic diversity of the latest mosasaurs. However, data for the coeval plesiosaurs are comparatively scarce. Recently, a large amount of plesiosaur material was discovered in the Oulad Abdoun Basin (Morocco). Although plesiosaurs essentially consist of isolated postcranial elements, a new genus and species of elasmosaurid plesiosaur, *Zarafasaura oceanis*, was erected based on some cranial remains. It represents the first valid elasmosaurid plesiosaur described from the latest Cretaceous of Africa, and the second one from this continent. The new cranial and post-cranial material shows that the latest Cretaceous plesiosaurs were, in this low latitude area (about 20°N), rather gracile, most likely piscivorous taxa. These plesiosaur fossils are also remarkable in that they consist of both juvenile and adult specimens, suggesting limited segregation between individuals of different ontogenetic stages, a feature that might be attributed to upwelling-related, high nutrient input and food availability in this area during the Maastrichtian. Moreover, the occurrence, associated with older specimens, of a supposed neonate specimen – one among the very few known worldwide – suggests a possible social structure organization. This new cranial and post-cranial plesiosaur material shows that Maastrichtian plesiosaurs were diversified and characterized by a relatively high degree of endemism. These inferences, together with the fact that Late Maastrichtian plesiosaurs had a worldwide distribution, support the hypothesis of a rather sudden extinction at the K/T boundary.



A possible new goose from the Upper Miocene of Mongolia

Natalia V. Volkova

Zoological Museum of the Moscow State University, Russia, Bol'shaya Nikitskaya street 6, Moscow 125009, volkovanatv@gmail.com

A significant portion of the Neogene avian fauna from localities of the Great Lakes Depression in western Mongolia is represented by ducks and geese. Several new forms have been described from this region during the decades by parties of the Joint Soviet – Mongolian Paleontological and Joint Russian – Mongolian Paleontological Expedition. A new coracoid of a goose described below comes from Hyargas Nuur 2 locality which has yielded several other forms of Anserini such as *Heteroanser vicinus* Kurochkin, 1976, *Bonibernicla ponderosa* Kurochkin, 1985, *Anser devjatkini* Kurochkin, 1971 and *Anser liskunae* Kurochkin, 1976. Hyargas Nuur 2 is located at the northern shore of Lake Hyargas Nuur and, according to the latest research, should be referred to the Uppermost Miocene (biozone MN13), close to the Miocene – Pliocene Boundary.

The complete right coracoid (PIN, no. 2614-166) generally has the shape typical for *Anser*, but there are some notable differences from extant representatives of this genus. A depression in the facies articularis clavicularis is deeper and more distinct than in extant *Anser*. Although the facies articularis clavicularis is slightly flattened against the shaft in the middle, as in other geese, it is undercut for its full extent like in *Branta* and *Nesochen*, not only in the dorsal part. This coracoid also has pneumatic foramina across all the extent of the facies articularis clavicularis like in *Branta* and *Nesochen*. The coracoid also has a small elongated notch, running from the top edge of the facies articularis scapularis to the brachial tuberosity. This structure may be similar to the groove in the same place in *Branta* and white geese, sometimes ranked as the genus *Chen*. The caudal edge of the facies articularis scapularis forms a strong ridge, stronger than in extant Anser.

The coracoid thus has a mixture of features of *Anser* and *Branta*. I refer it to the genus *Anser* because of the similar overall proportions and based on the preliminary results of a phylogenetic analysis. Strange morphology of this specimen possibly indicates that this is a new species; similarities with *Branta* may thus be plesiomorphic. This find may add to our knowledge of morphological evolution of geese in the Miocene.

A new robust enantiornithine bird from the Lower Cretaceous of China with scansorial adaptations

Min Wang[a,b], Jingmai K.O'Connor[a], and Zhonghe Zhou[a]

[a] Key Laboratory of Vertebrate Evolution and Human Origin, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing 100044, China. *wangmin_nju@163.com; jingmai.oconnor@gmail.com; zhouzhonghe@ivpp.ac.cn*

[b] University of Chinese Academy of Sciences, Beijing 100044, China

We describe a new enantiornithine bird from the Lower Cretaceous lacustrine deposits of the Jiufotang Formation in northeastern China. The unique morphology of the pectoral girdle of the new specimen distinguishes from other enantiornithine birds, supporting the erection of a new taxon. The new specimen is very robust compared to other enantiornithines and has a unique pedal morphology with metatarsal II much shorter than metatarsal IV, robust pedal digits with pronounced arched pedal unguals. The extreme curved unguals suggest scansorial adaption, which hint at a unique ecology for this taxon. Combined with recent discoveries from Jehol Biota, the enantiornithines occupied a great diversity of body plans in Early Cretaceous.

The northern-most fauna of fossil birds in Asia: Miocene birds from Baikal Lake (Siberia)

Nikita V. Zelenkov[1], Nikolay V. Martynovich[2]

[1] Borissiak Paleontological Institute of RAS, Moscow, Russian Federation;
e-mail: nzelen@paleo.ru
[2] Krasnoyarsk Regional Museum of Local Lore, Krasnoyarsk, Russian Federation;
e-mail: martynovichn@mail.ru

New avian remains from the Miocene locality Tagay (Olkhon Island, Baikal; East Siberia) were studied. A rich fauna of water birds from the locality includes nine taxa of waterfowl, small grebe, three herons, small calidrine wader and one more indeterminate charadriiform, two small rails, two phasianid birds, diurnal raptor and three taxa of indeterminate passeriforms. Such diversity makes Tagay the richest avian locality of Miocene age in Russia and one of the most important Miocene avian localities in Asia. Bird fauna from Tagay supports the early-middle Miocene age of this locality. The find of the fossil rail *Paraortygometra* for the first time documents wide latitude distribution of a Miocene genus of birds. The presence of a grebe (these birds normally absent in the fossil record prior to late Miocene) and the absence of flamingos, cormorants and ibises are remarkable.

Triassic pistosauroid *Yunguisaurus* (Reptilia; Sauropterygia) with Implications for the Origin of Plesiosauria

Li-jun Zhao[1],Tamaki Sato[2], Xiao-chun Wu[3], and Chun Li[4]

[1]Zhejiang Museum of Natural History, Hangzhou, China;
[2]Department of Astronomy and Earth Sciences, Tokyo Gakugei University, Japan;
[3]Canadian Museum of Nature, Ottawa, ON K1P 6P4, Canada;
[4]Institute of Vertebrate Paleontology and Paleoanthropology, China

Pistosauroids, the crown group of Sauropterygia, are well known for their derived representatives, the plesiosaurs formed a group that achieved considerable diversity and cosmopolitan distribution during the Jurassic and Cretaceous. However, our knowledge on the early members of the group, Triassic pistosauroids, has been limited because of the lack of good specimens, and their known temporal/geographic distribution are primarily limited to the Early and Middle Triassic of the Tethys and western North America.

Yunguisaurus Cheng *et al.,* 2006 is a pistosauroid sauropterygian recently discovered in the Middle Triassic of southwest China. The holotype specimen is a nearly complete juvenile skeleton. A newly discovered adult specimen reveals many morphological features not observed in the juvenile holotype skeleton. Size and morphological differences between the two specimens are mostly regarded as ontogenetic variation. The number of mesopodia (11 carpals and 8 tarsals) exceeds that known in any other Triassic marine reptiles. It demonstrates variability of the limb morphology among the Triassic pistosauroids. Among the primitive plesiosaurs the number of carpals and tarsals excluding supernumeraries are nearly identical in the fore and hind limbs: three proximal and three distal elements, and remains nearly constant throughout the Jurassic and Cretaceous. The long tail of *Yunguisaurus* likely represents the retention of ancestral condition and does not indicate functional adaptation. The pectoral girdles of Corosaurus, Augustasaurus and Yunguisaurus may indicate early stages of the adaptation towards the plesiosaurian style of paraxial limb movements with ventroposterior power stroke. The larger surface of the hind limbs in *Yunguisaurus* suggests their importance in locomotion before the development of the plesiosaur-like pectoral girdle for more sophisticated posteroventral movement of the forelimbs.

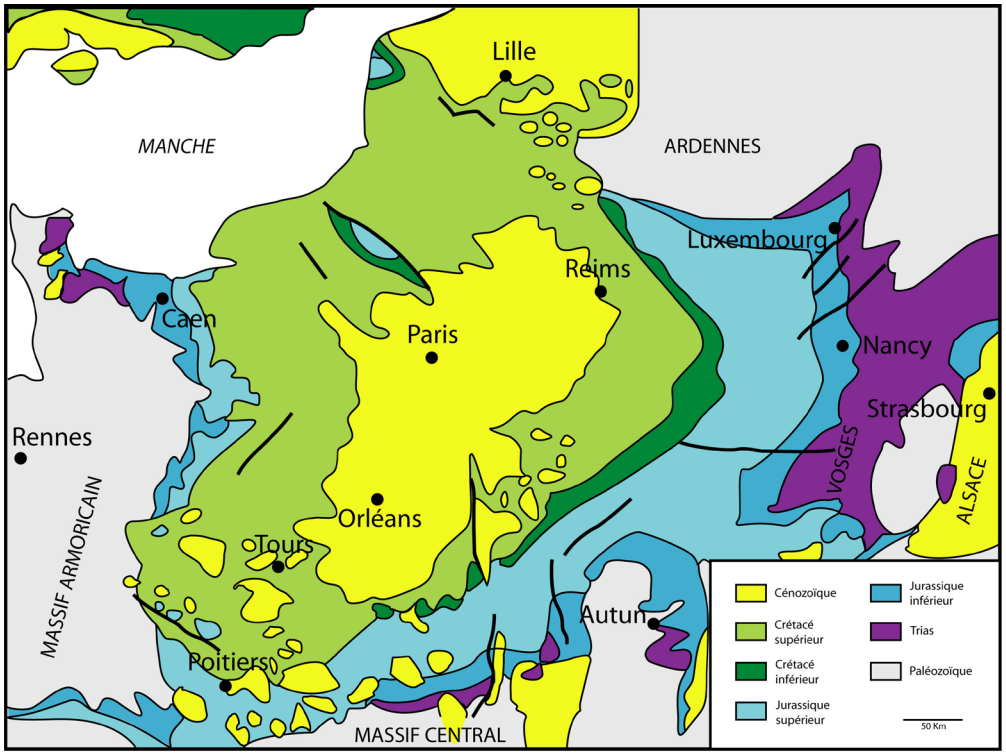
A three-dimensionally preserved basal ornithuromorph from the Jehol Biota with long fan-shaped tail feathers and food remains

Shuang Zhou,[*,1,2] Zhonghe Zhou,[1] and Jingmai O'Connor[1]

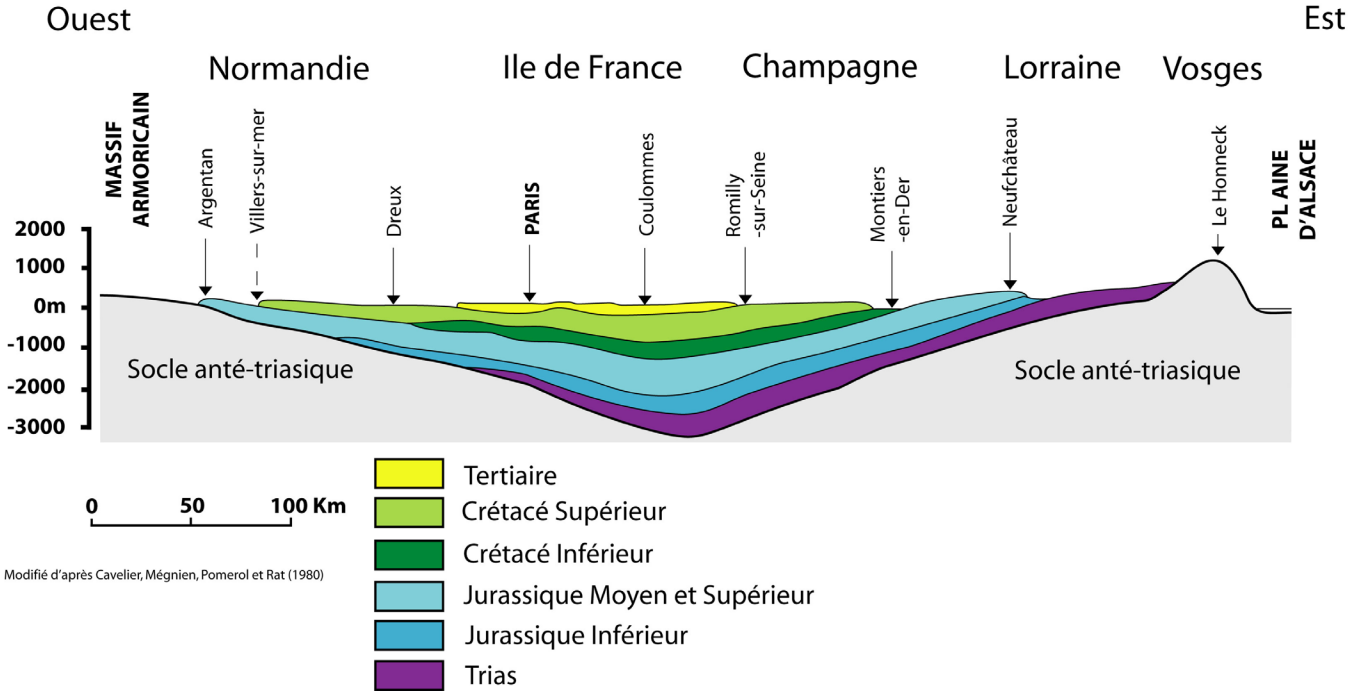
[1]Key Laboratory of Vertebrate Evolution and Human Origin of Chinese Academy of Sciences, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing 100044
[2]Graduate University of Chinese Academy of Sciences Beijing 100049
* Corresponding author. E-mail: zhoushuang_ivpp@163.com (Shuang Zhou)

We report on a new species of basal ornithuromorph bird, *Piscivoravis lii* gen. et sp. nov., based on a well-preserved and nearly complete specimen from the Lower Cretaceous Jiufotang Formation in western Liaoning, China. The new specimen preserves a unique combination of characters that differentiate it from other known avian taxa, including several anatomical features previously unreported in Early Cretaceous ornithuromorphs, such as a robust furcula with strongly tapered omal tips; a broad sternum without craniocaudal elongation; and large and strongly curved manual unguals. Phylogenetic analysis indicates that it is more derived than *Archaeorynchus*, but in a polytomy with *Jianchangornis*, *Patagopteryx deferrariisi* and the clade containing the other ornithuromorphs. The preserved wing and tail feather impressions shed new light on feather evolution in Early Cretaceous ornithuromorphs. The preservation of fish bones ventral to the dentary and in the stomach represents direct evidence the new taxon fed on fish. The strongly recurved manual unguals support interpretations of *Piscivoravis* as a predatorial bird.

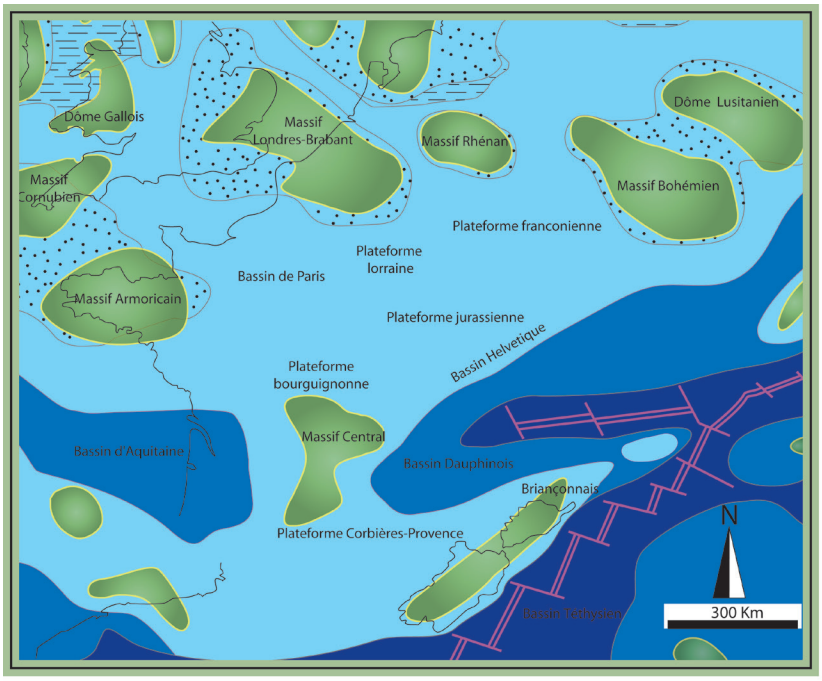
Fieldtrip

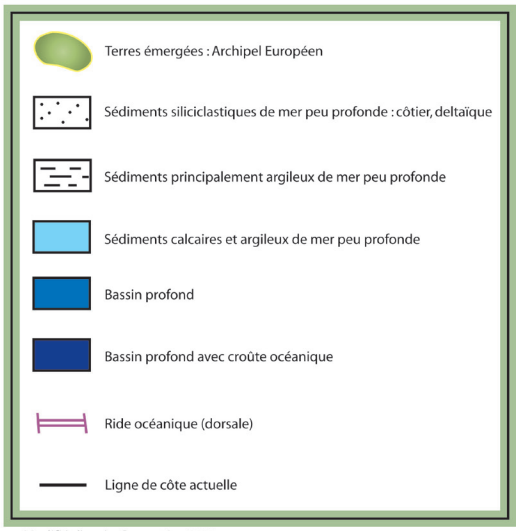


Modifié d'après http://ww.mnhn.fr
D'après la synthèse géologique du Bassin de Paris (1980) et la carte géologique de France au 1/1 000 000 ème (6ème ed., 1996)



Modifié d'après Cavelier, Mégnien, Pomerol et Rat (1980)





Modifié d'après Carpentier 2004

Carte paléogéographique de l'Europe durant l'Oxfordien, environ 160 Ma.

Paléospace l'Odyssée

avenue Jean Moulin

14640 Villers-sur-Mer

tel: 02 31 81 77 60

www.paleospace-villers.fr