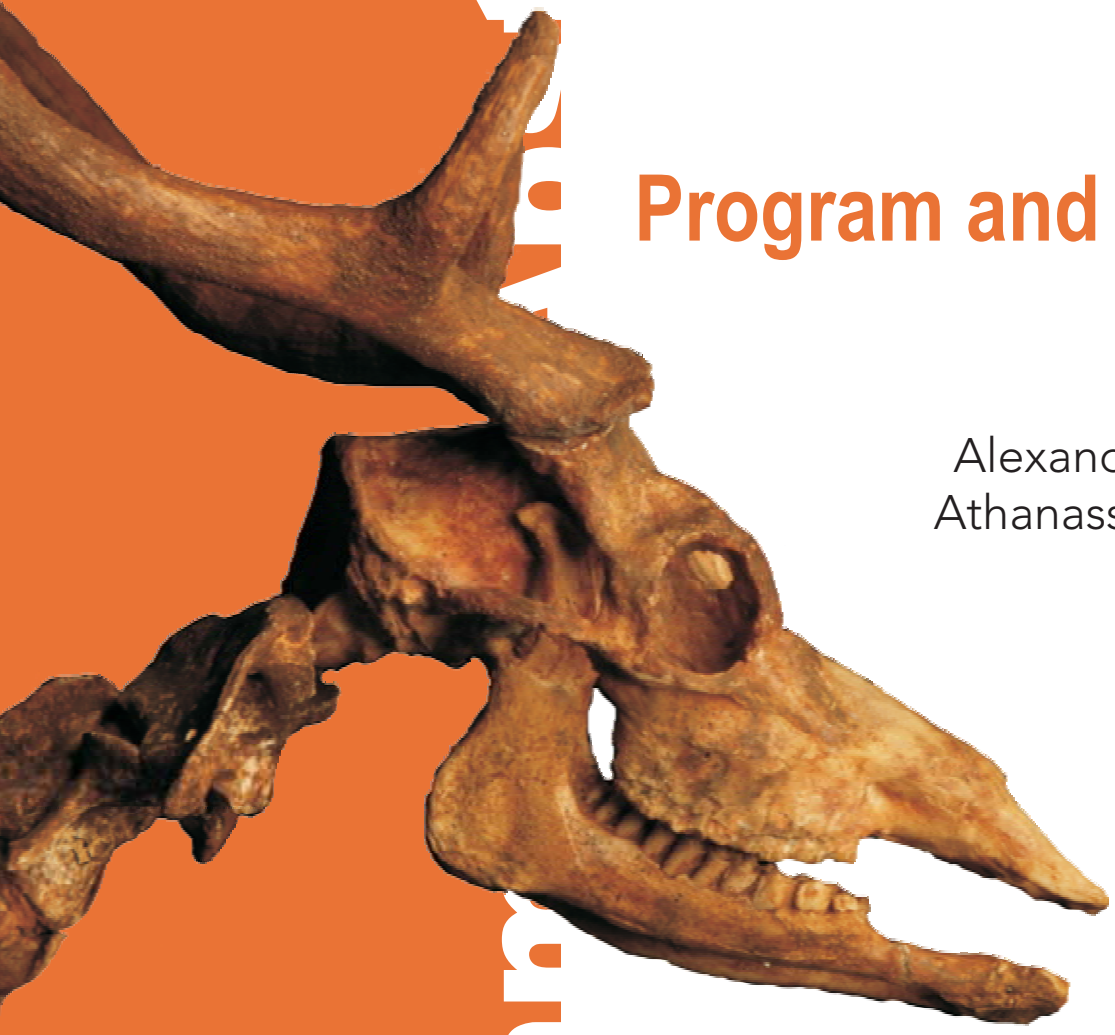
Program and Abstracts

European Association of Vertebrate Palaeontologists

9th Annual Meeting
Heraklion, Crete, Greece
14-19 June, 2011



Program and Abstracts

editors
Alexandra van der Geer
Athanassios Athanassiou

Natural History Museum of Crete
University of Crete

NCB naturalis

European Association
of Vertebrate Palaeontologists

9th Annual Meeting

Heraklion, Crete, Greece
14-19 June, 2011

Host Committee

George Iliopoulos[1], Charalambos Fassoulas[2], John de Vos[3], George Lyras[3], Alexandra van der Geer[3], Olga Tzortzakaki[1], Giannis Zidianakis[1], Dimitris Kostopoulos[4], Socrates Roussiakis[5], Athanassios Athanassiou[6]

Program and Abstracts

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ZARO'S
NATURAL MINERAL WATER
from Psiloritis mountains / από το βουνό του Ψηλορείτη

LYRARAKIS
CRETE

Zaro's Natural Mineral Water and Lyrarakis Wines provided the water and the wine served during this meeting.

Table of Contents

Program at a glance	1
Program	3
Poster presentations	9
Abstracts	13
List of participants	63

Program at a glance

TIME	WEDNESDAY	THURSDAY	FRIDAY	
9:00 am	**Welcome**	**Deesri**: *Lepidotes*	**Pardo-Pérez**: *Platypterygius*	
9:15 am	**de Vos**: *H. floresiensis*	**Cavin**: Mid-Cretaceus fishes	**Meyer**: taphonomy & ichnology	
9:30 am	**Herridge**: Cretan mammoth	**Sytcgevskaya**: Russian fishes	**Iliopoulos**: hyaenid footprint	
9:45 am	**Kolb:** Cretan deer	**Liston**: Pachycormiformes	**den Ouden**: woolly mammoths	
10:00 am	**Geiger**: Giant rodents	**Codrea**: Transylvanian fishes	**Wilson**: South American ungulates	
10:15 am	**Papayiannis**: Minoan microm.	**Argyriou**: fishes of Aegina	**COFFEE**	
10:30 am	**COFFEE**	**COFFEE**		
10:45 am			**Monninger**: pterosaur wings	
11:00 am	**Mallison**: stegosaur tails	**Stein**: bone microstructure	**Frey**: *Rhamphorhynchus* vs fish	
11:15 am	**Reiss**: *Plateosaurus* grasp	**Grigorescu**:taphonomy of Haţeg	**Buffetaut**: *Gargantuavis*	
11:30 am	**Lyras**: carnivore brain	**Prondvai**: *Rhamphorhynchus*	**Bell**: avian ecomorphology	
11:45 am	**Jungnickel**: mustelidae	**Mallouchou**: bone microstruct.	**O'Connor**: avian sternum	
12:00 pm	**Kuhn**: pinniped locomotion	**Merceron**: bovid O & C isotopes	**Michailidis**: Pikermi bird of prey	
12:15 pm	**Ősi**: Crocodyloforms jaw	**Buckley**: protein mass spectrom.	**LUNCH**	
12:30 pm	**LUNCH**	**LUNCH**		
12:45 pm				
13:00 pm				
13:15 pm				
13:30 pm			**POSTER SESSION**	**Workshop:** molding and casting techniques
13:45 pm				
14:00 pm	**POSTER SESSION**	**Codrea**:Eoc.-Oligocene boundary		
14:15 pm		**Athanassiou**: *Nyctereutes* size		
14:30 pm		**Mennecart**: *Gelocus quercyi*		
14:45 pm	**Weber**: The Journal	**Wattanapituksakul**:Thai rumin.		
15:00 pm	**Lauprasert:** Dino Thailand	**Kostopoulos**: *Oioceros* horns		
15:15 pm	**Le Loeuff**: a giant sauropod	**Palombo**: Faunal dynamics		
15:30 pm	**Tortosa:** Jas Neuf Sud	**Geraads**: L. Neogene mammals	**Erbajeva**: Siberian microm.	
15:45 pm	**Micklich**: Grube Unterfeld	**COFFEE**	**Vasileiadou**: Lesvos microm.	
16:00 pm	**Rabi**: *Archelon*		**Vasileiadou**:Kessani microm.	
16:15 pm	**Naksri**: Asian box turtles	**GENERAL ASSEMBLY ELECTION OF NEW BOARD**	**Mörs**: Miocene castorids	
16:30 pm	**COFFEE**		**COFFEE**	
16:45 pm				
17:00 pm	**Walen**: palaeoart		**Vasilyan**: giant salamanders	
17:15 pm	**den Ouden**: Maasvlakte 2	**Alcalá**: 10th EAVP meeting	**Laaß**: *Diictodon*	
17:30 pm	**Vlachos**: geotourism	**AUCTION**	**Renesto**: Triassic protorosaurs	
17:45 pm	**Theodorou**: Greek museums		**Marjanović**: Lissamphibia origin	
18:00 pm	**Vasileiadou**: biodiversity expo		**Closing session**	
18:15 pm	**Dermitzakis**: geoschools			

Program

TUESDAY 14th of June

17:00-19:30 **Registration (incl. payment)**
19:30-.... **Icebreaker party**

WEDNESDAY 15th of June

8:00-9:00 **Registration (incl. payment)**
9:00-9:15 **Meyer Ch. A. and Mylonas M.**
Welcome address

Chairperson: **De Vos J.**

9:15-9:30 **De Vos J., van der Geer A.A.E., Lyras G.**
Homo floresiensis is a hominid that evolved in an insular environment

9:30-9:45 **Herridge V., Iliopoulos G.**
Cape Melekas and Cretan Pleistocene Geochronology

9:45-10:00 **Kolb C., de Vos J., Scheyer T.M., Sánchez-Villagra M.R.**
The ontogeny of bone histology in the dwarfed island deer *Candiacervus* from the Late Pleistocene of Crete

10:00-10:15 **Geiger M., Wilson L.A.B., Costeur L., Scheyer T.M., Aguilera O.A., Sánchez-Villagra M.R.**
Giant rodents from the northern Neotropics - taxonomic, phylogenetic and developmental aspects of their evolution within the caviomorph radiation

10:15-10:30 **Papayiannis K.**
The micromammals from Minoan Crete: human intervention in the ecosystem of the island

10:30-11:00 **Coffee Break**

Chairperson: **Sánchez-Villagra M.**

11:00-11:15 **Mallison H.**
Hard hitters? A kinetic/dynamic look at stegosaur tails

11:15-11:30 **Reiss S., Mallison H.**
Grasping capabilities of *Plateosaurus engelhardti*

11:30-11:45 **Lyras G.**
First eat and then think: the relation between craniodental and neuroanatomical changes in carnivoran evolution

11:45-12:00 **Jungnickel S.N., Frey E.**
Anatomy, locomotion and constructional morphology of the polecat and the ferret (*Mustela putorius putorius* and *M. p. furo*, Mustelidae, Carnivora)

12:00-12:15 **Kuhn C., Frey E.**
Walking Like Caterpillars, Flying Like Bats – Pinniped Locomotion

12:15-12:30 **Ősi A.**
The evolution of jaw mechanism and oral food processing in heterodont crocodyliforms

12:30-14:00 **Lunch Break**

14:00-14:45 **Poster Session**

Chairperson: **Buffetaut E.**

14:45-15:00 **Weber S.**
The Journal "Palaeodiversity and Palaeoenvironments"

15:00-15:15 **Lauprasert K., Wattanapituksakul A., Laojumpon C., Buffetaut E. , Cuny G., Tong H., Martin J., Le Loeuff J., Claude J., Wongko K., Cavin L., Srisuk P., Khamha S., Suteethorn S., Deesri U., Naksri W., Suteethorn V.**
Dinosaur Valley of Thailand: The spectacular vertebrate fossil sites in Southeast Asia

15:15-15:30 **Le Loeuff J., Néraudeau D., Vullo R., Leprince A., Allain R., Buffetaut E.**
A giant sauropod from the Barremian of France

15:30-15:45 **Tortosa T., Dutour Y., Buffetaut E., Cojan I., Cheylan G.**
New discoveries of vertebrates from the Upper Campanian locality of Jas-Neuf Sud (Var, Southeastern France)

15:45-16:00 **Micklich N.**
Emergency excavation in the Grube Unterfeld (Frauenweiler) clay pit (Oligocene, Rupelian; Baden-Württemberg, S. Germany): New records and palaeoenvironmental information

16:00-16:15 **Rabi M., Göhlich U.B., Kear B.P.**
An exceptionally complete specimen of the colossal Cretaceous sea turtle *Archelon ischyros*

16:15-16:30 **Naksri W., Tong H., Thirakhupt K., Lauprasert K., Suteethorn V., Claude J.**
A new fossil of *Cuora* from the Miocene of Thailand sheds new light on the origin of Asian box turtles

16:30-17:00 **Coffee Break**

Chairperson: **Tsoukala E.**

17:00-17:15 **Walen A.**
From small pieces to big displays: the reconstruction of giant extinct species

17:15-17:30 **Den Ouden N.**
The Maasvlakte 2 Project: combining unique collection methods, multidisciplinary scientific research and participation of the general public

17:30-17:45 **Vlachos E., Tsoukala E., Mol D.**
Developing geotouristic routes in Northern Greece: a case study on the evolution of proboscideans based on the fossil record

17:45-18:00 **Theodorou G.E.**
On the need of systematic protection, study, conservation and management, of the Greek palaeontological treasures: Proposal for the establishment of the National Natural History Museum at Pikermi, Attica

18:00-18:15 **Vasileiadou K., Zouros N., Tsoukala E., Kostopoulos D.S., Iliopoulos G.**
Communicating past mammalian biodiversity: "From the deinothere of the Lesvos Petrified Forest to the Man of the Petralona Cave", a temporary exhibition in the Natural History Museum of the Lesvos Petrified Forest

18:15-18:30 **Dermitzakis M., Fermeli G., Meléndez G.**
GEOschools: a European project for innovative teaching of geosciences in secondary schools

THURSDAY 16th of June

8:00-9:00 **Registration** (for latecomers)

Chairperson: **Liston J.**

9:00-9:15 **Deesri U., Cavin L., Lauprasert K., Suteethorn V.**
Lepidotes buddhabutrensis (Actinopterygii, Holostei) from the Late Jurassic – Early Cretaceous of NE Thailand, and the evolutionary history of semionotiforms

9:15-9:30 **Cavin L., Läng E.**
"Mid-Cretaceous" continental vertebrate assemblages from the southern margin of the Tethys

9:30-9:45 **Sytchevskaya E.**
The new locality of freshwater fishes from the Eocene of Northern Primorye (Russian Far East)

9:45-10:00 **Liston J.J.**
The Palaeobiogeography of Cretaceous Pachycormiformes

10:00-10:15 **Codrea V., Jipa C.**
New data on the Maastrichtian fishes (Lepisosteidae and Characiformes) from Transylvania

10:15-10:30 **Argyriou T., Theodorou G.**
New findings from the Pliocene (Zanclean) ichthyofauna of Aegina island, Greece

10:30-11:00 **Coffee Break**

Chairperson: **Kostopoulos D.**

11:00-11:15 **Stein K.**
Bone microstructural requirements at large size and fibrolamellar bone convergence

11:15-11:30 **Grigorescu D., Csiki Z., Vasile Ş., Butiseacă G.-A.**
Taphonomic biases in macro- and microvertebrate assemblages from the Maastrichtian of the Haţeg Basin (Romania) and their relevance in the reconstruction of a fossil ecosystem

11:30-11:45 **Prondvai E., Stein K., Sander M., Ősi A.**
Life history of *Rhamphorhynchus* inferred from bone histology

11:45-12:00 **Mallouchou M.S., Stathopoulou E.T., Theodorou G.E.**
Contribution to the study of the effect of chemical conservative means on the microstructure of fossilised bones

12:00-12:15 **Merceron G., Lécuyer Ch., Kostopoulos D.S., Koufos G.D.**
Oxygen and carbon isotope compositions of extinct bovids and environments of primates in the Late Miocene of Greece

12:15-12:30 **Buckley M.**
New approaches to palaeobiology using protein mass spectrometry

12:30-14:00 **Lunch Break**

Chairperson: **Palombo M.R.**

14:00-14:15 **Codrea V., Maridet O., Venczel M., Fărcaş C., Solomon Al.**
New data on the terrestrial Eocene/Oligocene boundary in Transylvania (Romania)

14:15-14:30 **Athanassiou A., Lyras G.**
Nyctereutes megamastoides (Mammalia: Carnivora: Canidae): variation and evolution

14:30-14:45 **Mennecart B., Berger J.-P.**
A new taxonomy to accommodate *Gelocus quercyi* (Ruminantia, Mammalia), and its relationship with *Prodremotherium elongatum*

14:45-15:00 **Wattanapituksakul A., Lauprasert K.,**
Diversity of Ruminants in the Quaternary sites of Thailand

15:00-15:15 **Kostopoulos S.D.**
Horn twisting versus bovid phylogeny: the "*Oioceros* complex" example

15:15-15:30 **Palombo M.R.**
Faunal dynamics during the last 5 Ma: a case study of large mammals from the Western Mediterranean region

15:30-15:45 **Geraads D., Spassov N., Hristova L., Markov G.N., Garevska B., Garevski R.**
Large mammal faunas from the late Neogene of the F. Y. Republic of Macedonia

15:45-16:00 **Coffee Break**

16:00-17:15 **General Assembly and Election of New Board**

17:15-17:30 **Alcalá L.**
The 10th EAVP meeting

17:30-..... **Auction**

FRIDAY 17th of June

Chairperson: **Meyer Ch.**

9:00-9:15 **Pardo Pérez J., Frey E., Stinnesbeck W., Rivas L., Salazar, Ch., Leppe M.**
A new species of *Platypterygius* or a morphological variation? The difficulty to designate a new species, when the record fossil is scarce

9:15-9:30 **Meyer Ch.A., Frey E., Thüring B.**
Ichnological evidence of taphonomic feedback in vertebrates: Examples from the Late Jurassic and Cretaceous

9:30-45 **Iliopoulos G., Roussiakis S., Fassoulas C.**
Hyaenid footprint from the Late Miocene of Western Crete

9:45-10:00 **Den Ouden N.**
Body size patterns in Late Pleistocene woolly mammoths (*Mammuthus primigenius*) from Europe

10:00-10:15 **Wilson L.A.B., Madden R.H., Sánchez-Villagra M.R.**
Testing a developmental model in the fossil record: molar proportions in South American ungulates and in other mammals

10:15-10:45 **Coffee Break**

Chairperson: **Frey E.**

10:45-11:00 **Monninger S., Frey E.**
Backward, forward or completely different: wing sweep in pterosaurs

11:00-11:15 **Frey E., Tischlinger H.**
On the strange relation between the long-tailed pterosaur *Rhamphorhynchus* and fishes.

11:15-11:30 **Buffetaut E.**
Gargantuavis philoinos: giant bird or giant pterosaur?

11:30-11:45 **Bell A., Chiappe L.M.**
Identifying Trends in Avian Ecomorphology: applications to European Paleogene Birds

11:45-12:00 **O'Connor J.K., Zhou Z-H**
The Morphology and Early Evolution of the Avian Sternum

12:00-12:15 **Michailidis D., Roussiakis S.**
First recorded presence of a bird of prey from the Late Miocene of Pikermi (Attica, Greece); preliminary observations

12:15-13:30 **Lunch Break**

13:30-15:30 **Poster Session**

13:30-16:30 **Workshop: Introduction to basic molding and casting techniques by Aart Walen** (all materials, including safety gloves, will be provided)

Chairperson: **Vasileiadou K.**

15:30-15:45 **Erbajeva M.A., Alexeeva N.V.**
Plio-Pleistocene small mammal diversity in the south of East Siberia

15:45-16:00 **Vasileiadou K., Zouros N.**
Micro-mammalian inhabitants of the Lesvos Petrified Forest (Greece)

16:00-16:15 **Vasileiadou K., Konidaris G., Koufos G.D.**
New data on the late Miocene - early Pliocene micromammalian locality of Kessani (Thrace, Greece)

16:15-16:30 **Mörs T.**
Temporal evolution and biogeography of Miocene large Castoridae (Mammalia, Rodentia)

16:30-17:00 **Coffee Break**

Chairperson: **Athanassiou A.**

17:00-17:15 **Vasilyan D., Böhme M.**
Life style and life history of recent and fossil Eurasian Cenozoic giant salamanders (Cryptobranchidae; Amphibia)

17:15-17:30 **Laaß M., Frey E.**
An archosaur-like paratympanic sinus system in the anomodont *Diictodon*

17:30-17:45 **Renesto S.**
Skull morphology modification and dietary differences in the Triassic small protorosaurs *Macrocnemus* and *Langobardisaurus*

17:45-18:00 **Marjanović D., Laurin M.**
The matrix: detailed reevaluation of a large dataset demonstrates support for the “lepospondyl hypothesis” of the origin of Lissamphibia

18:00-18:30 **Closing session**
Refreshments and removing posters

SATURDAY 18th of June

8:00-..... **Field trip to Prassas and Katharo**

SUNDAY 19th of June

10:00-..... **Visit to Knossos**

Poster Presentations

(Wednesday 14:00-14:45 and Friday 13:30-15:30)

Alexeeva N.V., Erbajeva M.A.
Pliocene-Pleistocene sciurids of the Transbaikal area: time of diversification and evolutionary development

Athanassiou A.
The Late Pleistocene fauna of Peneios

Baykina E.M.
Two new species of the genus *Sardinella* (Pisces, Clupeiformes, Clupeidae) from the Eastern Paratethys (Ciscaucasian region, Russia)

Belvedere M., Baucon A., Furin S., Mietto P., Felletti F., Muttoni G.
The ICHNOBASE project: development of a sharing tool for ichnological data

Casanovas-Vilar I., Van Dam J.A., De Esteban-Trivigno S.
Mandible shape in squirrels and its relationship with size, ecology and phylogeny

Cobos A., Royo-Torres R., Gascó F., Alcalá L.
A new giant turiasaurian specimen from Riodeva (Teruel, Spain)

Company J. De Esteban-Trivigno S., Dondas A.
Bone histology of an immature *Scelidotherium* from the Lujanian of Argentina

De Esteban-Trivigno S., Fariña R.A.
Morphological variability in the lower jaw of armadillos: phylogeny or diet?

Delfino M., Rabi M., Gemel R., Chesi F., Scheyer T.M.
The type locality material of *Psephophorus polygonus* Meyer, 1847: whereabouts, gross morphology and histology

DeMiguel D., Azanza B.
Unusual climatic conditions in the middle Miocene of central Spain: evidence from the study of teeth of ungulate mammals

Dermitzakis, M., Fermeli G.
Museums' digitalized vertebrate collections as tools for educational scenarios for school students of compulsory education

Garcia G., de Lapparent de Broin F., de Bonis L., Koufos G.D., Valentin X., Kostopoulos D., Merceron G.
A new terrestrial Testudinidae from the Late Miocene hominoid locality "*Ravin de la Pluie*" (Axios Valley, Macedonia, Greece)

Gascó F., Cobos A., Royo-Torres R., Alcalá L., Mampel L.
Theropod teeth diversity from Riodeva (Teruel, Spain)

Hiard F., Fasel A. ,Berger J.-P.
Paleocene Plesiadapiforms and Eocene Euprimates from Europe: New material

Iliopoulos G., Athanassiou A., Konstantinou G.
A new dwarf elephant locality from the Late Pleistocene of Cyprus

Kostopoulos D., Koufos D.G.
Greek Anthracotheriids: breaking up a 50-year silence

Kümmel S., Frey E.
Evolution of autopodial rotation in Synapsida between the Permian and the Cretaceous

Laojumpon C., Suteethorn S., Suteethorn V., Lauprasert K.
New vertebrate-bearing localities from The Triassic of Thailand

Maniakas I., Youlatos D.
Myological adaptations to fast enduring flight in European free-tailed bats, *Tadarida teniotis* (Rafinesque, 1814)

Minwer-Barakat R., Marigó J., Moyà-Solà, S.
A new form of *Pseudoloris* (Omomyidae, Primates) from the Middle Eocene of the Almazán Basin (Iberian Peninsula)

Mitsopoulou V., Iliopoulos G.
The effect of tectonic movements and eustatic fluctuations on the immigration of Pleistocene mammals in the South Aegean Sea

Rabi M., Vremir M.
Evolution of dortokid turtles in the Late Cretaceous – Paleogene of Europe.

Rager L., Sánchez-Villagra M.R.
Heterochrony in cranial suture closure of recent and fossil Xenarthra

Royo-Torres R., Alcalá L., Cobos A., Espílez E., Gascó F., González A., Mampel L., Pesquero M.D.
A dinosaur “nursery” in a Lower Cretaceous clay quarry (Galve-Maestrazgo Geopark, Teruel, Spain)?

Rozzi R., Palombo M.R.
Functional morphology and palaeohabitat predictions: the case study of Plio-Pleistocene endemic bovids from Sardinia

Scherler L., Mennecart B., Becker D., Berger J.-P.
Oligocene to Early Miocene evolution of large terrestrial “hoofed-mammals” in Western Europe

Shelton C., Stein K., Sander M.
Utilizing morphometrics and histology of appendicullar skeletal elements to determine what *Dimetrodon* species are present in the Briar Creek bone bed (Lower Permian, Archer County, Texas)

Szentesi Z., Venczel M.
The first discoglossid frog from the Late Cretaceous (Santonian) of Hungary (Iharkút, Bakony Mountains)

Van der Geer A.A.E., Iliopoulos G., Lyras G.A., de Vos, J.
The Middle Pleistocene deer of the Katharo basin (Crete, Greece) and its importance for a better understanding of the evolutionary history of the insular fauna of Crete

Vasileiadou K., Zouros N., Fassoulas C. , Iliopoulos G.
Vertebrate fossils in Geoparks: a tool for the promotion of responsible tourism and the economic development of rural areas

Vislobokova I.
On the evolution and systematics of the tribe Megacerini (Artiodactyla, Cervidae)

Vlachos E., Tsoukala E.
New finds of giant tortoises from Thessaloniki area: the most complete of *Cheirogaster* Bergounioux, 1935 skeleton in Greece

Walen A.
Taking scientific studies to the public: the Dino Expo skeletons

Wattanapituksakul A., Asselin G., Lauprasert K., Srisuk P.
Ancient settlement from Kao Ego, Phetchaburi Province, Thailand

Wongko K., Lauprasert K., Buffetaut E., Suteethorn S., Suteethorn V.
The palaeoenvironment of the spinosaurid-bearing strata in the Khok Kruat Formation from Northeastern Thailand

Abstracts

Pliocene-Pleistocene sciurids of the Transbaikal area: time of diversification and evolutionary development

Alexeeva, N.V. [1], Erbajeva, M.A.[1]

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The Transbaikal area, located in the middle of the continental interior of Asia, is characterized by the alternation of deep intermountain depressions and chains of ranges covered with deep taiga, forest-steppes and steppes. They are inhabited by small mammal faunas including the steppe (*Marmota sibirica*) and black-cupped (*Marmota camtschatica*) marmots, long-tailed Siberian ground squirrel (*Spermophilus undulatus*) and Siberian chipmunk (*Tamias sibiricus*).

The earliest fossil record of Transbaikalian marmots is known from the Middle Pliocene. The oldest species is *Marmota tologoica*, a component of *Hipparion* faunas. The species composition of those fossil faunas, pollen, flora and geological data show that savanna-like forest-steppes were prevailing during the Middle Pliocene. The climate was moderately warm, but not sharply arid. Detailed morphological analysis shows that this extinct species was close to modern *Marmota camtschatica* in the tooth structure and skull features. The Middle Pleistocene was the time of diversification and speciation of both Transbaikalian marmots, which became an ancestral form of the extant *Marmota sibirica* and *Marmota camtschatica*.

The earliest record of ground squirrels in the area is also known from the Middle Pliocene (Beregovaya site), but their fossils are rather scarce. During the Late Pliocene explosive radiations of the genus *Spermophilus* took place. It was represented by two subgenera, *Spermophilus* and *Urocitellus*, which continued to exist during the Early Pleistocene. In the Middle Pleistocene *S.* (*Spermophilus*) *tologoicus* disappeared and *S.* (*Urocitellus*) *gromovi* became the dominant form in the faunas. During the Late Pleistocene this taxon was replaced by the extant form (*Spermophilus undulatus*) which is one of the most important representatives of the modern Transbaikalian faunas.

New findings from the Pliocene (Zanclean) ichthyofauna of Aegina island, Greece

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The presence of fossil fish in the Pliocene (van Hinsbergen *et al.*, 2004) diatomites of Aegina island was first mentioned by Livaditis (1974). However, it was only recently that the components of this fossil ichthyofauna were studied (Argyriou, 2010, Gaudant *et al.*, 2010). During the last three years a series of excavations (SARG NKUA 70/4/3370, 70/3/1685) of these Pliocene (Zanclean) diatomites led to the recovery of a considerable number of fossil fish samples. This work focuses on the recovered material from a new locality, situated approximately 800 m to the south-east of Aghios Thomas Hill. The identifications are based on the literature (e.g. Arambourg, 1927; Carnevale, 2003) while the total number of identified fish remains is 44. Among them, the remains of *Bregmaceros albyi* (Bregmacerotidae) and *Spratelloides gracilis* (Clupeidae) are the commonest. The number of individuals of both identified species is 26 and 15 respectively. Moreover, remains of two individuals of pipefish *Syngnathus* cf. *acus* (Syngnathidae) and one individual of deep-sea hatchet fish *Argyropelecus* sp. (Sternoptychidae) were also recognized. Finally, the overall composition of the ichtyofauna indicates that the fossiliferous diatomites were deposited in shallow tropical waters in contact with the open sea.

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The Late Pleistocene fauna of Peneiós Valley (Lárissa, Thessaly, Greece): new collected material

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Peneiós is the main river that drains the Thessalian Basin. In the eastern part of the basin (sub-basin of Lárissa) the river cuts into its own Pleistocene deposits bringing mammal fossils, as well as Palaeolithic artefacts, to light. The finds are located west of the city of Lárissa, at the riverbed area between the mouth of Kalamáki gorge and the city. The Peneiós fauna is already known from earlier publications (Milójčić *et al*., 1965; Schneider, 1968; Athanassiou, 2001). Most of the new material was collected during the last ten years, at time periods when the water level was low enough to reveal the fossils on the riverbed. The most abundant taxa are the elephant *Elephas antiquus* and the aurochs *Bos primigenius*. The presence of the ibex *Capra ibex*, at least three cervid taxa (referable to *Megaloceros*, *Cervus* and *Capreolus*), two species of horses (*Equus ferus* and *E. hydruntinus*), the rhino *Stephanorhinus hemitoechus* and a hippo (*Hippopotamus* sp.) is also confirmed in the available sample. The new collection does not add any new faunal element for the locality, but contributes to the better knowledge of the Late Pleistocene fauna of eastern Thessaly, by adding many new specimens. The fauna is biochronologically dated to the Late Pleistocene, which is corroborated by existing radiometric dates (about 40 ka) for the lower terrace of the river (Demitrack, 1986).

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Nyctereutes megamastoides (Mammalia: Carnivora: Canidae): variation and evolution

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The extant raccoon-dog, *Nyctereutes procyonoides*, is characterised by marked morphological and metrical variation across its rapidly expanding Eurasian biogeographical range (Kauhala et al., 1998). The Villafranchian (Late Pliocene – Early Pleistocene) faunas also include a widely spread raccoon-dog, larger than the extant one and known as *N. megamastoides* in Europe and *N. sinensis* in Asia. Our study focuses on the variation of *N. megamastoides*, based mainly on fossil samples collected from Early Pleistocene localities of Greece. Two of them, Sésklo (Thessaly) (Athanassiou, 1998) and Vaterá (Lesbos Island) (De Vos *et al*., 2002) are particularly interesting, because they have yielded morphologically and metrically extreme samples, despite their similar age and the small geographical distance between them. The *N. megamastoides* from Sésklo is very large and robust; its dentition is high crowned and the molar grinding area is weak, implying thus a more carnivorous diet. The Vaterá specimens are instead much smaller and slenderer, with a dentition implying a hypocarnivorous diet. Other localities yielded intermediate samples. We conclude that *N. megamastoides* has a wide intraspecific morphological and metrical variation, which is mainly expressed as differences among localities than as intrapopulation variation. This reflects that

each population was evolutionary adapted to slightly different niches, separated from each other geographically and/or chronologically.

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Two new Sarmatian species of the genus *Sardinella* (Pisces, Clupeiformes, Clupeidae) from the Eastern Paratethys (Ciscaucasian region, Russia)

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Two collections of clupeid fishes of the genus *Sardinella* have been studied from the Lower and the Middle Sarmatian of the Pshekha River basin (Ciscaucasian region, Russia). Originally the Lower Sarmatian form has been determined (Carnevale *et al*., 2006) as *Sardinella sardinites* (Heckel) based on similarity to the specimens from the Middle Oligocene of the Caucasus (Danil'chenko, 1980: 9-10). It was established that the Lower Sarmatian species of *Sardinella* represents a new taxon, synonymous to neither *Meletta sardinites* Heckel, nor *Clupea sardinites* and *Sardinella sardinites* (see synonymy in Carnevale *et al*., 2006).

The new species is characterized by low body, unique shape of the praeoperculum and presence of seven branchiostegal rays. The pelvic fins are placed below the posterior third of the dorsal fin base; the dorsal fin is situated forward to the middle point of the body. Vert. 44-46 (4+28 (29) +12 (13)), D 17-18, A 13-14, V 8. The shape of the praeoperculum, the number of branchiostegal rays, the fewer number of vertebrae and rays in the anal fin and also the length of the lower jaw distinguish the Lower Sarmatian form from all recent species of the subgenus *Sardinella* and the majority of the fossil species.

The Middle Sarmatian form from the Pshekha River basin also represents a new species of *Sardinella*. This larger form (up to 160 mm of standard length) is characterized by a unique shape of the praeoperculum and a large number of vertebrae. The pelvic fins are placed below the central point of the dorsal fin base; the dorsal fin is above the centre of the body. Vert 48-50 (5+28 (30) +15 (16)), D 16-17, A 18, V 8. This species differs from all recent species of the subgenus *Sardinella* by the shape of the praeoperculum and a greater number of vertebrae. Large size, greater number of vertebrae and the position of pelvic fins distinguish it from the Lower Sarmatian species and the majority of the other fossil species. These *Sardinella* species may be used as index fossils for the Sarmatian deposits of the Eastern Paratethys.

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Identifying trends in avian ecomorphology: applications to European Paleogene birds

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As members of the most taxonomically diverse group of organisms, the Archosaurs, modern birds are strikingly diversified. They occupy a wide ambient range, and thus display an amazing variety of lifestyles. Skeletal morphometrics are a reasonable proxy to understand avian ecomorphological trends. This study expands on a previous ecomorphological analysis of 500 modern bird species through the addition of approximately 20 European Paleogene bird species. Europe's excellent Early Tertiary record of fossil birds enables the use of morphometric tools to quantitatively analyze the ecological distribution of early crown-group avians. Paleogene birds included in this study cover a broad taxonomic range, including early representatives of the Galliformes, Apodiformes, and Coraciiformes, among others; and range in age from the Late Paleocene / Early Eocene Fur Formation

of Denmark to the Late-Middle Eocene Messel Formation of Germany. The results of this analysis allow us to compare basal members of crown-clade birds with their modern counterparts in terms of skeletal proportions and correlated ecological roles, offering a unique perspective on the early evolution of modern birds in Europe.

The ICHNOBASE project: development of a sharing tool for ichnological data

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During the last decade, several research groups have started using new methods for the documentation of footprints (laser-scanner, photogrammetry) that brought to the diffusion of three-dimensional models. These techniques come alongside the classical methodologies used since the beginning of vertebrate ichnology to share data and trace morphologies, i.e., outline drawings and qualitative descriptions of tracks. Though these methods are still fundamental for the definition and the understanding of vertebrate tracks, they introduce a high level of subjectivity, which do not allow a precise quantitative approach to ichnology. Modern approaches introduce an objective way for collecting data, but, their sharing is still related to direct contact among authors, thus preventing that jump towards a quantitative approach that ichnology needs.

The ICHNOBASE project thus aims to create the first comprehensive online database on trace fossils, allowing to organize, store, and retrieve large amounts of ichnological information. The project bases on a relational database controlled by a web-interface for data input and retrieval. The architecture of ICHNOBASE consists of three interconnected levels, corresponding to bibliographic, taxonomic and morphological data, as well as detailed stratigraphical and sedimentological data of the site/surface bearing the traces

The intention of the ICHNOBASE project is to become the reference database for ichnologists, who can use it to exchange classical and 3D data, geographical information. It thus enlarges the possibility for each researcher to access objective data and improve the shift toward quantitative ichnology.

New approaches to palaeobiology using protein mass spectrometry

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Recent advances in mass spectrometry techniques now allow for the analysis of small amounts of protein recoverable from particular well-preserved fossils. The main interest to palaeontologists is in the ability to utilise sequence information from long extinct taxa for improving our understanding of phylogeny, some examples of which are given in this paper including mastodons, mammoths and various species of dwarfed Mediterranean hippopotami. However, in addition to detailed sequence analysis, relatively simple 'peptide mass fingerprints' (PMFs) can be obtained to quickly identify large numbers of morphologically unidentifiable bone fragments to better understand the palaeobiodiversity of a particular site. Although the ability to recover such information from Mesozoic fossils including dinosaurs is highly debated, which likely depends on both the age and preservation of the fossil as well as the methods used to extract and analyse the protein, this research demonstrates that simple PMFs can be regularly obtained from fossils of at least 1.5 Ma from British sites. What is particularly unexpected is that even with a highly conserved bone protein such as collagen it is possible to obtain species-specific information amongst various types of taxa.

Gargantuavis philoinos: giant bird or giant pterosaur?

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The presence of a giant bird in the Late Cretaceous of southern France was first reported by Buffetaut *et al.* (1995) on the basis of a synsacrum fragment from Fox-Amphoux (Provence). Subsequently, Buffetaut and Le Loeuff (1998) described a new taxon, *Gargantuavis*

philoinos, on the basis of a pelvis and a referred femur from two Late Cretaceous localities (Campagne-sur-Aude and Villespassans) in Languedoc. All currently known *Gargantuavis* specimens are from localities of late Campanian to early Maastrichtian age. *G. philoinos* was described as an ostrich-sized bird showing various primitive characters suggesting that it was a relatively basal, non-ornithurine form. Although the avian nature of *Gargantuavis* has been accepted by many authors, Mayr (2009: 21), quoting a personal communication from Worthy, suggested "a possible pterosaurian identity of *Gargantuavis*" and hinted that it was in fact a large azhdarchid. This was based mainly on the assumption that the cranially located acetabulum of *Gargantuavis* is more reminiscent of pterosaurs than of birds. However, in pterosaurs the acetabulum is not in a cranial position, and from that point of view *Gargantuavis* is more reminiscent of some giant birds, such as *Gastornis*, than of pterosaurs. Similarly, the stout femur of *Gargantuavis* is very different from the long, slender femur of pterosaurs. Mayr's contention that "the wide pelvis of *Gargantuavis* is very unlike the narrow one typically found in large groundbirds (ratites, Gastornithidae, Phorusrhacidae)" is only partly correct. Running groundbirds such as living ratites and phorusrhacids do have narrow pelves, but various extinct graviportal groundbirds, including some moas, gastornithids and dromornithids, had broad pelves. There is thus no reason to assume that *Gargantuavis* was a giant pterosaur rather than a giant bird. Moreover, the recent discovery in the Upper Cretaceous of Cruzy (southern France) of a typically avian large cervical vertebra, presumably belonging to *Gargantuavis*, further confirms the original conclusion that *Gargantuavis* was a giant groundbird.

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Mandible shape in squirrels and its relationship with size, ecology and phylogeny

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We analyzed mandible shape in extant squirrels (Sciuridae, Rodentia) using two-dimensional landmark-based morphometrics and further assess its correlation with size, phylogeny and broad ecological preferences. The correlation of shape with size was tested using a multivariate regression of Procrustes shape coordinates on centroid size. Our results show that scaling in squirrel mandible is generally isometric, and that the different squirrel subfamilies show the same size-related trends in mandible shape. The presence of a phylogenetic signal in the morphometric data was tested using a permutation test which simulates the null hypothesis of complete absence of phylogenetic structure. In addition, we calculated shape consistency and shape retention indexes, which provide a measure of homoplasy in morphometric data. In most cases, the null hypothesis of independency could not be rejected and the indices consistently indicated a low degree of homoplasy, clearly stressing the role of phylogeny. Finally, the relationship between shape and ecology was studied with canonical variates analysis (CVA) using different grouping variables: broad dietary preferences, main habitat and lifestyle. Those squirrels showing the more extreme adaptations (such as those feeding mainly on insects, mosses or grasses) are clearly distinguished, although the discrimination of the most abundant dietary classes, frugivory and granivory, remains problematic. Because of its strong relationship with phylogeny, we conclude that mandible shape is probably not a good proxy to the palaeoecology of extinct squirrels, even though some particular adaptations may be easily recognizable.

"Mid-Cretaceous" continental vertebrate assemblages from the southern margin of the Tethys

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During the late Early Cretaceous and the early Late Cretaceous, the southern margin of the Tethys was mainly formed by North Africa and the northern part of South America, both blocks being separated by the incipient South Atlantic. In North Africa, a continental series named "Continental Intercalaire" records deposits mostly from the Early Cretaceous to the Early Cenomanian (basal Late Cretaceous). There is now good evidence that Cenomanian deposits that occur from eastern North Africa (Bahariya, Egypt) to western North Africa (Kem Kem beds, Morocco) contain a similar vertebrate assemblage. New findings from the Cenomanian Alcântara Formation in northeastern Brazil indicate that vertebrate components of North Africa are also present on the South American block. The typical taxa characterizing these assemblages are the shark Onchopristis, the lungfish "*Neoceratodus*" africanus, the coelacanth *Mawsonia*, the polypterid *Bartschichthys* and several dinosaur taxa (Rebbachisauridae, Spinosaurinae, Carcharodontosauridae). Although the degree of phylogenetic affinity between most of the taxa from these different localities remains to be measured, the correspondence of the taxa at generic or (sub)familial rank, as well as the similarity between the composition of the assemblages and, apparently, between ecological conditions may indicate the existence of rather similar ecosystems spreading over huge spatial area. Observations have been made of localised fish assemblages with high degree of endemism, for instance the "OT1" assemblage in the Kem Kem beds, Morocco, but these seem to have been isolated elements, and they do not alter the general impression of the occurrence of a spatially huge similar ecosystem extending along the southern margin of the Tethys. This hypothesis should now be tested by comparing the available published data more deeply, and by accumulating new field data. Such an ecosystem, if real, would have had no equivalent today.

A new giant turiasaurian specimen from Riodeva (Teruel, Spain)

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Supervising surveys on the more than fifty places with dinosaurs documented in Villar del Arzobispo Formation (Tithonian-Berriasian) in Riodeva (RD) (Teruel, Spain) in 2010, new remains appeared in the site called San Lorenzo (RD-28). This site was found in 2004 and has provided 217 dinosaur fossils *ex situ*, most of them not identified, although an anterior caudal vertebra has been classified as Macronaria indet. Once the excavation works were initiated, cranial fragments (including ten isolated teeth) of a large sauropod dinosaur have been identified. From its postcranial skeleton, which is outstanding for its great robustness, we have recovered until now: a nearly complete ulna, a right femur and tibia with lengths of about 1.92 m and 1.25 m, respectively, fifteen anterior and medial caudal vertebrae with their respective chevrons, and two astragali. The teeth of this specimen exhibit heart-shaped crowns with a pointed and asymmetrical apex that is strongly compressed labiolingually, as well as a convex labial surface with a bulge that extends from the base towards the apex. These characters are distinctive of the Turiasauria clade. If the study of new remains confirms its attribution to *Turiasaurus riodevensis*, which was defined in RD-10 site and is also present in RD-13, then its skeleton would be nearly complete.

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New data on the Maastrichtian fishes (Lepisosteidae and Characiformes) from Transylvania

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Until now, the single location with continental Maastrichtian fauna including fishes was the Haţeg Basin, with fossils originating from typical fluvial sequences. The material collected there is referred to Acipenseriformes, Characiformes and Lepisosteidae. Recent survey in the Maastrichtian sedimentary Metaliferi area (Alba County) revealed a new, extremely rich site at Oarda de Jos, bearing various microvertebrates, including bones and teeth of dinosaurs (*Zalmoxes*, *Telmatosaurus*), fishes, lissamphibians, crocodiles, turtles and mammals. The fish remains consist mostly of isolated teeth, a few jaws fragments, scales and vertebrae. These fossils document the presence in this locality of two families: Lepisosteidae and Characidae.

Lepisosteids are represented by various different morphotypes of teeth. The first type is massive, cylindrically shaped, with rounded base and crowned occlusal surface. It could be related to ?*Lepidotes*. The second type is more robust than the previous one, with the tip becoming suddenly narrow, straight or curved. The third type —predominant— is conical, more elongate than type 2, exposing parallel ridges on the enamel surface. Here, two subtypes can be outlined: pointed, which may be assigned to *Lepisosteus*, and lanceolate, referable to *Atractosteus*. Scales are predominant rhomboidal, thick and covered by ganoine. A few but fragmentary opisthocoelous vertebrae belong to the same lepisosteids.

Characiformes are documented only by a small sample of isolated teeth. Two types can be separated, based on the number of cusps. The first type bears two cusps, one higher and much larger than the other. The lingual and labial faces of the teeth are slightly convex and have a triangular outline. The second type has three cusps: a higher one in the middle flanked by two smaller cups that are relatively similar to each other both in size and shape.

This new locality is the richest one in Maastrichtian fishes in Romania (until now, 556 teeth and scales were collected), because in Haţeg Basin such fossils are by far rarer.

New data on the terrestrial Eocene/ Oligocene boundary in Transylvania (Romania)

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Eocene/Oligocene continental deposits of fluvial origin deposited on northwestern side of the Transylvanian Basin (Romania) are currently included in the following formations: Valea Nadăşului and Turbuţa (late Eocene, Priabonian), Moigrad and Dâncu (early Oligocene, Rupelian). During the last years, several vertebrate localities found in these formations yielded assemblages indicative of the faunal turnover that took place around the Eocene/Oligocene boundary.

The Priabonian localities Bociu, Morlaca, Rădaia, Treznea and Stâna yielded: glassfishes (Ambassidae) and garfishes (Lepisosteidae), frogs, lizards, turtles (?*Mauremys*), crocodilians, but also mammals: marsupials (*Peratherium* ?*lavergnense*), insectivores, the oldest European hamsters (?*Eocricetodon*), as well as some newly discovered large herbivores: an amynodont (probably *Sharamynodon*) and the first brontothere found in Transylvania after a century and a half (*Brachydiastematherium*-size).

The Rupelian vertebrate localities Cluj-Napoca, Suceag, Mera, Huedin yielded various teleostean fishes (*Dapalis*, *Morone*, etc), salamanders (*Mioproteus*), frogs (*Latonia*, *Pelophylax,* as well as a new species of palaeobatrachid frog), lizards (Anguidae indet.*)* snakes (*Eoanilius*, cf. *Bransateryx* sp.), turtles, crocodiles (*Diplocynodon*) and mammals: insectivores (*Quercysorex*), hamsters (*Paracricetodon* and *Eucricetodon*), a dormouse (?*Bransatoglis*), small sized anthracotheres (*Elomeryx borbonicus*), and large herbivores already reported previously, such as indricothers, entelodons, rhinos (*Ronzotherium*) etc.

These vertebrate faunas document the arrival in Romania of mammals of Asian origin before the Eocene/Oligocene boundary, supporting the closing of the Turgai strait in the late Eocene. In the early Oligocene vertebrates are noticeably different from the Eocene ones, suggesting a second migration event, possibly occurring at the beginning of the Oligocene.

Bone histology of an inmature *Scelidotherium* from the Lujanian of Argentine

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Fossil xenarthrans constitute one of the worst known mammalian group. Ecology and physiology of this group remain mostly uncertain. Moreover, recent xenarthrans species display peculiar physiological adaptations. Extant sloths are almost heterothermic, and most species of armadillos have body temperatures two degrees below the normal temperature in other mammals. For this reason it is especially interesting to study the histology of these extint species.

Scelidotherium was a ground sloth with well-developed digging abilities, which body mass was about half a tonne. It has been proposed as the possible builder for the large late Cenozoic burrows present in the Pampean region. The bones analyzed were recovered from the Mar del Plata area and belong to the same individual.

Transverse thin-sections of cortical bone taken from appendicular elements and ribs of an immature *Scelidotherium* specimen exhibit a well-vascularised primary fibrolamellar bone dominated by woven tissue and large vascular canals, organized in circular rows. The canals are board and in most cases incompletely filled with centripetally deposited osteonal bone. The outermost vascular canals are even larger because osteonal tissue has not started to deposit in this recently formed bone. The innermost periosteal cortex is highly resorptive, displaying large erosion rooms reflecting the expansion of the medullar cavity. As it would be expected, no structures of arrested growth are developed. This richly vascularised fibrolamellar bone tissue refers to the relatively fast bone growth characteristic of late juvenile to subadult individuals.

Morphological variability in the lower jaw of armadillos: phylogeny or diet?

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Armadillos are the most widespread and species-rich group of the typically South American order Xenarthra, a clade with relatively few living taxa but with a long and diverse Cenozoic history. The relationship between shape and diet in this group has been studied, but it is not clear to which extent phylogenetic or functional factors have been more important in the evolution of the group. Here the extent of the dietary adaptations in extant cingulates is analysed with the aim of helping to understand the adaptations of extinct species by using generalized Procrustes analysis on 17 landmarks in lateral view of the jaws of 11 armadillo species.

After removing the effects of size, a PCA was carried out on the shape variables. PC1, clearly associated with phylogeny, explains 80% of the variance in shape, separating terrestrial generalist insectivores from the rest. *Dasypus* shows a high coronoid process, reduced angular process and the ascending ramus forming a wider angle with the dentary. When *Dasypus* is removed from the analysis the phylogenetic signal persists, although at a smaller degree. The negative part of PC2 (11.8 %) characterises specialised insectivores as having a proportionally longer dentary and a smaller condylar process. Both features are usually found in insectivorous species and are associated to small muscle attachment areas. *Clamyphorus truncatus*, despite being a generalist insectivore, is grouped with the rest of its clade (omnivorous forms). The historic factor seems to be responsible for its shape, with the exception of its reduced coronoid process, the only character related to an insectivorous diet. *Dasypus* shows a mixed morphology, with characteristics associated with an insectivorous diet (elongated and low dentary, reduced angular process) and others related to food processing in the mouth, such as the high coronoid process that implies a leverage improvement for the temporal muscles. That combination of characters explains 80% of the lower jaw shape variance in extant armadillos. Even when non-xenarthran species are included, *Dasypus* remains peculiar in its morphology, being placed in the most positive values of PC1.

Unusual climatic conditions in the Middle Miocene of central Spain: evidence from the study of teeth of ungulate mammals

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The Early to Middle Miocene is one of the most remarkable and interesting intervals for investigating the influence of major climatic changes on environments. In the case of the meridional areas of Europe, such as the Mediterranean regions, several global climatic transitions profoundly affected the ecosystems and had an important driving force in mammalian evolution. The Miocene Climate Optimum (onset 17Ma, offset 15Ma) represents a warm and humid period characterized by tropical and dry conditions, and its signal and effects in central Spain have been recently identified through the dental wear of many of the herbivorous mammals that witnessed this event. From this point, subsequent global climatic changes are known to have occurred.

Here, we reconstruct the diets of middle Miocene Late Aragonian (MN6-MN7/8; 13.75-11.1 Ma) cervids and bovids from central Spain (Calatayud-Daroca Basin) by analyses of dental micro- and mesowear, and use diets as environmental proxies to reconstruct the climatic conditions that prevailed in this area after an epoch of alleged climatic transition. Our results indicate that, in general, ruminants inhabited dry and seasonal landscapes, as has been interpreted traditionally. However, more browsing and less intermediate signatures and less grass-dominated mixed feeders in assemblages of MN7/8 strongly point to the presence of somewhat different conditions. Thus, wear patterns on teeth seem to reflect a considerable humid episode and a change in the vegetation in the transition from MN6 to MN7/8, which is in full agreement with the sudden decrease in temperature, the so-called middle-Miocene Cooling that is well-known to have occurred just after the Miocene Climate Optimum.

Homo floresiensis is a hominid that evolved in an insular environment

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Since the discovery of *Homo floresiensis* many papers have been published expressing different opinions about its origin (for an overview, see Aiello 2010). The original idea was that *H. floresiensis* is a descendant of *H. erectus* and that its small size is the result of an evolutionary adaptation to the insular environment of Flores. However, this scenario was soon challenged. Some researchers suggested that the specimen is a modern but pathological *Homo sapiens* and some others that it is phylogenetically related to a, yet undiscovered, pre- *Homo erectus/ergaster* hominid. The interpretation of a pathology had limited acceptance, but many researchers accepted the origin from a small-bodied early *Homo*. Such a phylogenetic scheme can be justified by many anatomical features of this hominid. However, it requires the adoption of an hypothetical scenario, namely, that hominids more primitive than *Homo ergaster/erectus* were the first to exit Africa. The oldest *Homo* found outside Africa is the 1.7 million year-old *H. georgicus* from Dmanisi, Georgia, which is intermediate between *H. habilis* and *H. erectus* (Vekua *et al*., 2002)

In this contribution we demonstrate that insular dwarfism is the most plausible explanation for the anatomical features seen in this small hominid. Such a phylogenetic scheme is in line with the palaeontological evidence (Van der Geer *et al*., 2010), and does not require the adoption of a new, hypothetical scenario. The most parsimonious solution is that hominids evolve on islands in the same fashion as the rest of the mammals do.

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Lepidotes buddhabutrensis (Actinopterygii, Holostei) from the Late Jurassic – Early Cretaceous of NE Thailand, and the evolutionary history of semionotiforms

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Lepidotes buddhabutrensis is a semionotiform fish species described on the basis of fragmentary remains from the Late Jurassic – Early Cretaceous of NE Thailand (Cavin *et al.*, 2003). Systematic excavations of the site Phu Nam Jun yielded ca 300 specimens. Morphometric analyses of this sample showed that all specimens belong to a single population (Deesri *et al.*, 2009). A detailed morphological description of *L. buddhabutrensis* makes it one of the best known species of semionotiforms. It shows a number of specialisations, in particular related to its jaw apparatus, indicating a detritious or herbivorous diet very different from the durophagous diet of the Jurassic type species *L. elvensis*. New examinations of Jurassic and Cretaceous semionotiforms, together with recent descriptions of new taxa by various authors, revealed that this group of fish diversified in freshwater environments during the Early and 'mid' Cretaceous worldwide, and probably occupied ecological niches similar to those of modern cypriniforms. A phylogenetic analysis including the best known species of semionotiforms indicates that several taxa, including *L. buddhabutrensis*, are stem Lepisosteiforms (Cavin, 2010). Together with the recently recognised family Obaichthyidae (Grande, 2010), these taxa shed new light on the evolutionary history of gars during the late Mesozoic. Several Jurassic and Cretaceous localities from NE Thailand have yielded semionotiform remains, some of them complete enough to be assigned at a specific level. The current study of this material will provide important data for a better assessment of the diversity of these fishes in SE Asia and of their possible roles in the evolutionary history of the gar lineage.

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The type locality material of *Psephophorus polygonus* Meyer, 1847: whereabouts, gross morphology and histology

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Psephophorus polygonus Meyer, 1847 (Testudines, Dermochelyidae) was described on the basis of shell ossicles coming from the Middle Miocene (MN6-7/8) of Devínska Nová Ves (Slovakia). The whereabouts of this material is uncertain but it possibly is in the collection of the Naturhistorisches Museum Wien: a slab on display at the same institute with partly connected and partly disarticulated ossicles, is considered as the neotype. We recently analyzed isolated ossicles from the type locality in the collections of the same Museum (87 ossicles), the Institut für Paläontologie at Universität Wien (5 ossicles), and the Magyar Természettudományi Múzeum in Budapest (112 isolated ossicles and a small slab with a few dozen connected ossicles). We re-evaluated the gross morphology of these ossicles of *P. polygonus* and described for the first time their microstructure, by comparing them

with *Dermochelys coriacea*, the only living dermochelyid turtle. The gross morphology of this material is congruent with that already described for *P. polygonus*, with one significant exception that requires a reconsideration of the diagnostic traits of *P. polygonus* and *D. coriacea*: one keeled ossicle has a distinctly concave, and not a flat, ventral surface. Both flat and keeled ossicles of *P. polygonus* show similar histological structures, i.e. compact diploe structures with an internal cortical coarse fibrous meshwork, whereas the thinner *D. coriacea* ossicles lose the internal cortex, an thus their diploe, during ontogeny. The ossicles of both *P. polygonus* and *D. coriacea* differ from those of other lineages of amniotes whose armour is composed of polygonal ossicles or platelets, in having growth centres situated at the plate centres just interior to the external bone surface and not within the cancellous core or closer to the internal compact bone layer.

Body size patterns in Late Pleistocene woolly mammoths (*Mammuthus primigenius*) from Europe

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Various claims have been made that the woolly mammoth *Mammuthus primigenius* dwindled in size towards its extinction. This presumed Lilliput effect has led to speculations. It could, for instance, be the result of habitat fragmentation, leading to 'isles' of suitable habitat within the ecosystem. Thus, size changes could be related to a special variety of the island rule. However, a quick scan of the data in the literature makes one wonder if sometimes this small size exists only in the eyes of the beholder. Conspicuously missing in the discussion is an overview of the variation of the woolly mammoth through time, which has not been quantified since the epic work of Maglio (1973). Particularly in a species which displays a respectable amount of sexual dimorphism, such a baseline needs to be established before we can draw any conclusions.

The North Sea is one of the largest resources for mammoth material in the world. Most of the material is housed in the Dutch natural history museums and in private collections in the Netherlands. These collections provide an extraordinary opportunity to study the size and morphology of the mammoths from this area, spanning the period between 50,000 and 22,000 years ago. Not only the sheer size of the collections available, but also their find location makes it an important study area. The North Sea mammoths lived at the western edge of the species' natural distribution. As climatic changes are likely to influence the populations in the periphery of the biotope first, we would expect physical changes —for instance due to habitat fragmentation— to be observable in the Dutch and British woolly mammoth fossils. A large portion of the North Sea specimens have been measured, focusing initially on third (last) molars. A number of specimens were subsequently selected for radiocarbon dating. The results of both the morphological and the radiocarbon analyses provide a baseline variation study, allowing a comparison to those of other localities.

Preliminary results show that the variation in the woolly mammoth is larger than is generally presumed. New material uncovered since the study of Maglio (1973) has considerably broadened the range of morphological features found within the species. Also, we tentatively suggest that the Lilliput effect is at least not as pronounced as has been previously claimed.

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The Maasvlakte 2 Project: combining unique collection methods, multi-disciplinary scientific research and participation of the general public

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In the 1960s a large area of land was created just south of Rotterdam to make an expansion of the Rotterdam port possible. The sand used to create this land yielded a large amount of Pleistocene fossils and the Maasvlakte has ever since been a very popular locality for amateur palaeontologists. Now a second expansion of the Port of Rotterdam (Maasvlakte 2) is well underway. Understandably, the expectations for this new locality are very high.

Scientifically, Maasvlakte 2 is a very interesting project. Because the dredging and depositing of the sands are minutely monitored, it is possible to reconstruct provenance areas for the fossils within it. The possibility of linking fossils to other find categories such as mollusks, gravels, flints, wood and peat clumps is an added value in comparison to the isolated finds from Maasvlakte 1.

Because the area is classified as work terrain, it is closed off for collection activities. Fortunately the authorities did allow a test with a Mega Beach Cleaner for collection of sediments. This Mega Beach Cleaner collected the first fifteen centimetres of top soil in a trajectory of 2.5 km and deposited it into large bags which were then transported to NCB Naturalis for further research. To test the efficiency of the Mega Beach Cleaner against traditional surveys by trained people, we also conducted a regular survey of the research area.

The processing of the sediments collected by the Mega Beach Cleaner provided an excellent opportunity to give amateur palaeontologists a chance to work on the material and also to educate the general public. In total seventy amateur researchers helped us to sort twelve cubic metres of sediments, the results of which will be used for further scientific research. Another cubic metre was collected especially for scientific purposes and we were able to educate seven hundred children and their parents about the prehistory of the North Sea and have them involved in picking out and recognising bones and shells.

Museums' digitalized vertebrate collections as tools for educational scenarios for school students of compulsory education

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The Geological and Palaeontological museum of the University of Athens, based on the digitization project of a part of the Museum's collections, has created a trilingual interactive multimedia production designed in order to enhance the awareness, provision of information and education of school students mainly in matters of palaeontology. The aim of this production, under the title "Journey in Time and Space", was to support: a) the scientific literacy of school students and b) encourage cross thematic educational procedure in schools (Fermeli and Dermitzakis, 2008).

"Journey in Time and Space" through interactive activities lead to further questions for investigation which may be answered through examination of the "real" objects and information available at the museum. Especially, the vertebrate collection offers an excellent opportunity to combine exhibition material and digitalized collections in order to develop scenarios for interactive educational multimedia applications for school students. Through an educational environment that promoted the development of observation skills, quest for information, decision-making procedures, critical thinking and systematization and following the spiral development of the material, two sets of activities were designed: one for Primary and one for Secondary education (Fermeli and Dermitzakis, 2010).

Through describing such initiatives, we hope to provide inspiration to other researchers to "open" scientific collections to school students, as well as to develop computer-supported collaborative learning environments in order to support geosciences literacy.

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GEOschools: a European project for innovative teaching of geosciences in secondary schools

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Teaching geology as a separate discipline in secondary school curricula has been progressively reduced during the last twenty years in most European countries. Within this unfavorable situation a proposal was made for an innovative "Geoscience teaching in secondary schools" (GEOschools) in the framework of a European research project. The main objective would be, by means of a thorough analysis of the current educational situation, to provide the European earth sciences education school community with advice, sup-

port, and different teaching aid instruments (Fermeli *et al*., 2011). GEOschools aims to bring together geoscientists from universities, museums, geoparks, teaching training institutions and schoolteachers. Among the key results of the project is the development of teaching modules on specific geological subjects. The ultimate goal of this part of the project is to find effective ways of engaging students and geosciences teachers in a new learning approach, placing geology at the same level of other sciences in secondary schools. Geology is a science laboratory of which is Earth. For this reason, "field work" is selected as the main methodological background for the development of this topic. In order to test and evaluate the proposed modules some selected activities will be proposed to bring the teachers and practicing geoscientists together. This will include fieldwork in geoparks, exomuseums (e.g. Katharo in Crete, Greece) and geotopes, as well as teaching activities in museums and in the classroom (Meléndez *et al*., 2009). GEOschools whishes to improve teacher's teaching and students' understanding of geosciences. Moreover, combining educational research and practice in the schools; ideas, knowledge and skills that it supports will contribute to the development of a quality lifelong learning and promote a European dimension in systems and practices in the field helping young people acquire the basic life-skills and competences necessary for their personal development, for future active European citizenship.

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Plio-Pleistocene small mammal diversity in the south of East Siberia

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Small mammals (insectivores, lagomorphs and rodents) are important components of modern mammalian faunas of Siberia. They belong at least to twelve families, including more than 28 genera. The studied region consists of two territories — Transbaikalia and Prebaikalia. In the past, small mammals were more abundant and diverse. The earliest record of extinct small mammals in the region is from the Late Miocene, characterized by predominance of archaic dipodids, lophocricetins and the presence of *Microtodon* and *Microtoscoptes*. Early Pliocene faunas were more diverse, including taxa with wide Eurasian distribution, such as murids, *Hypolagus*, *Stachomys*, *Kowalskia*, *Sicista*, *Ochotonoides*, *Prosiphneus*, *Promimomys*. The latter two genera were dominant in the faunas. The Middle Pliocene was characterized by the reduction of siphneids and *Promimomys* and the increase and diversification of lagomorphs and rodents. For the first time, the arvicolids *Mimomys*, *Villanyia*, *Pitymimomys*, the peculiar hamster *Gromovia* and the small sized *Cricetulus* appeared, whereas *Kowalskia* still existed. The characteristic features of the Late Pliocene are the explosive radiation and abundance of the ground squirrel *Spermophilus*, the first appearance of *Clethrionomys*, *Cromeromys* and *Allactaga*, the reduction of the rooted vole *Mimomys*. The cementless *Villanyia eleonorae* and *Prosiphneus praetingi* were replaced respectively by the more advanced *V. klochnevi* and *P. youngi*. In the beginning of the Early Pleistocene, reorganization in the small mammalian faunas occurred. Almost all Pliocene rooted voles disappeared and *Borsodia*, *Allophaiomys*, *Terricola*, *Lasiopodomys*, *Eolagurus*, *Microtus* appeared and flourished. The observed biodiversity increase was probably caused due to a climatic change towards cooler and drier conditions. Faunal analysis indicates that during the Pliocene and Early Pleistocene southern Siberia was inhabited by common Transbaikalian and Prebaikalian taxa. In the Middle Pleistocene the first three above-mentioned genera disappeared. *Ellobius*, *Lagurus* and *Meriones* appeared due to the increase of aridity and decrease of temperature. During the Late Pleistocene the climate in the Transbaikal area became cold and arid, and in Prebaikalia cold, but less dry. Faunas differed significantly. In Prebaikalia inhabitants of tundra-forest-steppe or mammoth steppe landscapes were characteristic, whereas in Transbai-

kalia inhabitants of open dry cold wormwood steppes were predominant.

On the strange relation between the long-tailed pterosaur *Rhamphorhynchus* and fishes

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Pterosaurs, those magnificent reptiles from the Mesozoic, were predominantly piscivorous with the exception of some insectivores — so it is speculated. Indeed, there is only little direct fossil evidence for of the final meal inside the digestive tract of pterosaurs. Remnants of fish inside the body cavity or the throat are reported *Eudimorphodon*, *Rhamphorhynchus*, *Pterodactylus* and *Pteranodon* (Benton 1994, Bown 1943, Wellnhofer 1975, Wild 1978). However, it remains unclear where and how these fishes were collected, and in which condition they were prior to being eaten. Even more sparse is the record of pterosaurs that fell prey to other animals. The sad remnants of an *Eudimorphodon* within an assumed fish pellet is to date the only evidence for a violent termination of a pterosaur´s life (Dalla Vecchia et al. 1989). A new specimen from the Solnhofen limestone, a *Rhamphorhynchus* that lies in the immediate vicinity of the jaws of a large *Aspidorhynchus*, proves evidence that this *Rhamphorhynchus* had a very ambiguous relationship to fishes: The stomach of the pterosaur is full of half-digested fish remains. A complete leptolepidid fish is still sticking in the throat of the pterosaur. The little fish was about to be swallowed head first, when the pterosaur was seized by the *Aspidorhynchus*. The fish attacked from behind and grabbed the wing membrane. The membrane tissue got tangled between the teeth of the fish and jammed. The pterosaur almost certainly drowned after being pulled under water. The fish, unable to continue swimming properly, exhaustedly sank into the hostile depths of the Solnhofen lagoon, where it finally suffocated. Sadly, the wing membrane of the pterosaur failed to preserve.

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A new terrestrial Testudinidae from the Late Miocene hominoid locality “Ravin de la Pluie” (Axios Valley, Macedonia, Greece)

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Numerous fossiliferous outcrops have been discovered along the Axios Valley in Northern Greece. Among them, the Vallesian locality of “Ravin de la Pluie” (MN 10) located in the red-brown clastic deposits of the Nea Messimvria Formation, has yielded a rich diversified mammal fauna, including the hominoid *Ouranopithecus macedoniensis* (Bonis and Koufos, 1999; Koufos, 2006). A single terrestrial testudinid specimen found in this locality corresponds to the genus *Testudo*: the specimen, a small, nearly complete carapace, has a well-distinct hypo-xiphiplastral hinge, a diagnostic character of this genus. The specimen is characterized by the following features which allow us to propose a new species: tectiform shell shape with a deeply indented nuchal anterior border and long, posteriorly elevated, and rounded from side to side, dorsal epiplastral lip. It represents the most ancient terrestrial Testudinidae known, prior to *T. marmorum* from Pikermi, Greece (MN 11-12), the previous most ancient record (Lapparent de Broin *et al.*, 2006a, b).

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Theropod teeth diversity from Riodeva (Teruel, Spain)

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Thirteen isolated theropod teeth have been recovered from five different outcrops in Riodeva (Teruel, Spain) belonging to the Villar del Arzobispo Formation (Tithonian-Berriasian). Only one of these teeth, whose apical length measures 9.8 cm, was previously assigned (to an Allosauroidea). A linear regression analysis including the seventeen best preserved teeth — which could be regarded as maxillary or posterior dentary teeth— showed that the main sample could be divided in three groups:

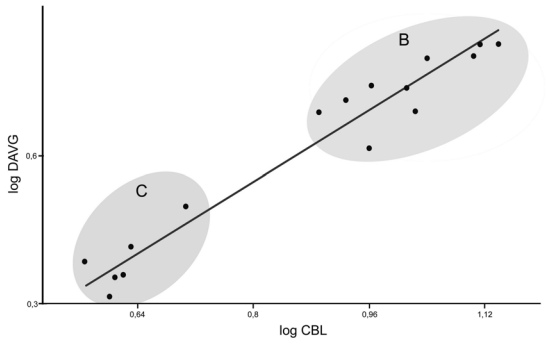
Morphotype A, including only the aforementioned Allosauroidea tooth.

Morphotype B, including a group of smaller teeth, but with an apical length larger than 25 mm. Their morphology is similar to *Allosaurus* teeth, and they could belong to a middle-sized allosauroid.

Morphotype C, a group of quite small teeth labelled as being more strongly curved in their mesial border than in the distal border. These teeth could be related to maniraptorans.

(Finally, there is a fourth morphotype D, which was not included in the analysis because it was problematic to measure all needed parameters. This group consists of two teeth which have D-shaped cross sections of the crown and are labiolingually less compressed. This morphotype could be related to Tyrannosauroidea.)

The relationship between the average denticle density on the distal margin (DAVG) versus crown base length (CBL) in the 17 best preserved teeth is visualized below. The linear regression includes morphotype A (x = 1.6, y = 1.3) although it is not represented in this graph (r = 0.9656).



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Giant rodents from the northern Neotropics: taxonomic, phylogenetic and developmental aspects of their evolution within the caviomorph radiation

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In the last decade, several fossils of giant caviomorph rodents from the Miocene of Venezuela were collected by teams from Zürich and Coro. These materials allow the first examination of ontogenetic and taxonomic variation in these animals in the context of caviomorph evolutionary radiation. We examined continuous and discrete features in a sample of seven fossil specimens (cf. *Phoberomys*) and 149 recent ones representing 46 species. We investigated the order of maturation and fusion of the epiphyses of long bones (humeri and femora) and the pattern of evolution of nine discrete characters of the femur, the postcranial element most commonly preserved among the stud-

ied fossils. We found that the epiphyseal closure series of femora is conservative within the rodent clade. The ossification of the humeral epiphyses is similar in rodents and other mammalian clades (e.g. Carnivora, Eulipotyphla). The pattern of evolution of femoral features is largely homoplastic and there are no obvious correlations with ecology or phylogeny. Some but not all peculiarities of the fossils are most likely linked to their gigantic size. The re-examination of a Miocene femur of a giant rodent from Trinidad in the collections of the Naturhistorisches Museum in Basel lead to its identification as cf. *Phoberomys*, a taxon principally known from the Urumaco section in north-western Venezuela. Current studies of its palaeohistology are revealing features of the growth pattern and functional architecture of the bone microstructure of these giants.

Large mammal faunas from the late Neogene of the F. Y. Republic of Macedonia

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There are many late Neogene localities in the Republic of Macedonia, most of them located in the Vardar (Axios) basin, but their large mammal faunas remain virtually unknown, as they are either still unpublished, or published only in local journals. We have undertaken a revision or study of the material housed in the Macedonian Museum of Natural History, and preliminary results are presented here. More than 40 species, from 22 localities probably ranging in age from the Vallesian/Turolian boundary to the late Turolian, have been identified as belonging to the late Miocene. Among the main localities, those of Umin Dol, Kiro Kucuk, Karaslari, Vozarci, can easily be referred to the middle Turolian, in spite of some peculiar features. Perhaps the localities of Prsten and Bachibos, in the south-eastern part of the country, are older in age, as the latter locality has yielded the bovid *Mesembriacerus*, previously known only from Ravin de la Pluie in Greece. Most species are identical with those from the nearby localities of Greece and Bulgaria, but important specimens of the proboscideans *Deinotherium*, *Tetralophodon* and *Mammut*, of the felid *Paramachaerodus*, of the primate *Mesopithecus*, of several rhinos and hipparions, of the giraffe *Bohlinia* and of a newly described gigantic species of *Sivatherium*, the latter probably of Pliocene age, are worth noticing. Well-preserved skulls of the ailurid *Simocyon primigenius* and of the felid *Metailurus parvulus* entitled us to revise these species and address the systematics and phylogeny of these genera. In terms of relative abundance, by comparison with nearby localities, the Upper Miocene localities of the Republic of Macedonia are noticeable by the abundance of the suid *Propotamochoerus*, the absence of the rhino *Ceratotherium*, and especially by the rarity of the antelopes of the *Protoryx – Pachytragus* group, but the abundance of spiral-horned forms, rare farther north, and the absence of the Ukrainian *Hipparion verae*, show that this region definitely belongs to the Balkano-Iranian province.

Taphonomic biases in macro- and microvertebrate assemblages from the Maastrichtian of the Haţeg Basin (Romania) and their relevance in the reconstruction of a fossil ecosystem

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In spite of, mostly objective, constrains, palaeoecologic reconstructions can be performed with acceptable accuracy when detailed and reliable taxonomic, taphonomic and sedimentologic data are available. These conditions are fulfilled for the Maastrichtian continental deposits of the Haţeg Basin, that yielded more than seventy vertebrate taxa from fishes to mammals, from various continental, mostly alluvial, environments, and were subjected to rigorous taphonomic analyses.

One important contribution to the reconstruction of an ancient ecosystem arises from the combined use of data derived from vertebrate accumulations with distinctive sets of taphonomic features. Such accumulations underwent different taphonomic histories, and thus potentially sampled the same ecosystem under differential biases. In order to gauge the influence of different preservational settings on our understanding of the local faunal composition, some of the most important macro- and microvertebrate sites from the Hateg Basin were investigated in the present study.

These sites are representative for different sedimentary settings and accumulation types, have yielded a large number of specimens, and were excavated thoroughly. Thus, these different types of accumulations are considered to provide a good estimate of the biases and potential plus-information .

The investigated sites include one largely autochthonous (Budurone) and one allochthonous (Fântânele) microvertebrate bonebed from poorly drained floodplains, one allochthonous macrovertebrate bonebed (Cărare) from channel deposits, and one largely autochthonous macrovertebrate bonebed with microvertebrates (Tuştea) from well-drained floodplain deposits. Each of these sites yielded different faunal assemblages, both in taxonomic composition, and in abundance of the individual taxa, but interpreted together they offer a key to the better understanding of the composition of the local paleo-ecosystem.

Cape Melekas and Cretan Pleistocene geochronology

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The Cape Melekas fossil fauna has become the focus of renewed interest following the publication of ancient DNA data (aDNA) by Poulakakis *et al.* (2006) supporting a *Mammuthus* ancestry for '*Elephas*' *creticus* Bate, 1907. This aDNA evidence was further claimed by the authors to be one of the oldest fragments amplified to date, with an estimated age of over 800,000 years. Although this study was strongly contested by the ancient DNA community, the attribution of *Mammuthus* has gained traction within the palaeontological, as it is in agreement with previously expressed views (Bate, 1907; Mol *et al.*, 1996), and the age of the Cape Melekas fauna is also widely accepted. Here we review the underlying geochronological evidence for Cretan Pleistocene vertebrate localities and present morphological evidence, and preliminary data from recent field work that demonstrates the following: (i) that the Cape Melekas elephants are indeed *Mammuthus*, and probably descended from *M. meridionalis*; (ii) that *Kritimys kiridus* and *M. creticus* are found together in the same depositional units; but that (iii) Cape Malekas cannot be assigned an age of >800,000 years on the basis of current evidence. In addition, we introduce our current project to establish a robust geochronology for key Pleistocene localities on Crete and other Mediterranean islands.

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Paleocene Plesiadapiforms and Eocene Euprimates from Europe: New material

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In February 2011, the Museum of Natural History of Fribourg (Switzerland) acquired several mandibles and jawbones of Plesiadapiforms and Euprimates. The entire batch includes the species *Plesiadapis tricuspidens* (1 half-mandible), *Platychoerops* sp. (1 half-mandible), *Adapis parisiensis* (2 half-mandibles and 1 half-jawbone), *Leptadapis magnus* (1 mandible), *Cryptadapis tertius* (1 half-mandible), *Cryptadapis* sp. (1 half-mandible), *Necrolemur antiquus* (3 half-mandibles and 3 half-jawbones) and *Pseudoloris parvulus* (3 half-mandibles and 2 half-jawbones). Most of them only show molars and premolars, except the half mandible of *Platychoerops* sp. in which the tooth row is nearly complete (only the m3 is lost) and in which the incisor is well preserved. Both plesiadapiforms (*Plesiadapis tricuspidens* and *Platychoerops* sp.) are from North-Eastern France (Cernay-les-Reims and Le Quesnoy). *Leptadapis magnus* is from Euzet, in Southern France. The other specimens are from the Quercy phosphorites in South-Western France (La Bouffie, Perriere and Sainte Néboule). All are dated to the Eocene except for *Plesiadapis tricuspidens*, which is Late Paleocene in age.

The mandible of *Platychoerops* sp., found in Le Quesnoy, could correspond to *Platychoerops* n. sp. announced and described by Godinot *et al.* (1998) but not yet named (Godinot pers comm.). In this case, given its well-preserved state, this mandible may be of great interest to the knowledge of this new species.

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New dwarf elephant material from the Pleistocene of Cyprus

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Cyprus is a large Mediterranean oceanic Island that was inhabited during the Late Pleistocene by an endemic fauna, consisting mainly of a pygmy hippopotamus (*Phanourios minor*) and a dwarf elephant (*Elephas cypriotes*). Until now, more than forty fossiliferous localities have been found on the island (Van der Geer *et al*., 2010), the majority of which are caves, collapsed caves and rockshelters. Recently, fossil specimens of elephants and hippos were collected by one of the authors (GK) from a new open air locality, a roadcut section in the area of Xylophagou (Eastern Cyprus). The same area has already yielded fossil mammal remains (Boekschoten and Sondaar, 1972; Theodorou *et al*., 2005). The bone-bearing bed consists of well-cemented green sandstone. The fossils were found scattered in a distance of more than 500 m. The sandstone is located in the middle of a sequence with alternations of marls and thin marly limestones with *Cerastoderma* shells, overlain by coarse and poorly sorted conglomerates. The marls and marly limestones indicate deposition in a lagoonal environment. The material recovered at the new locality comprises mainly cranial and postcranial elements referred to *E. cypriotes*, including several complete molars and one complete tusk. The *P. minor* specimens are scarce at Xylophagou, unlike other Cypriot localities. In addition to mammalian specimens, a small number of bird bones that belong to a large raptor have been also collected. The discovery of a mammal-bearing bed in a lagoonal sequence can provide significant data concerning the stratigraphy and the palaeoenvironment of Cyprus during the Late Pleistocene in relation to its endemic large mammals.

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Hyaenid footprint from the Late Miocene of Western Crete

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Although terrestrial Miocene deposits as well as faunal and floral findings are numerous and widespread in Greek Neogene sedimentary rocks, trace fossils are sparse and are limited mainly to casts of roots and invertebrate ichnofossils. No footprints of terrestrial vertebrates and especially of mammals have been reported from the Greek Neogene to date. This is fairly strange considering that there are several important Miocene mammal localities found all over Greece. Nine terrestrial mammal localities of Miocene age have been reported from the island of Crete: five in Lassithi prefecture, one in Heraklion prefecture, two in Rethymnon prefecture and one in Chania prefecture. Their age spans from the Middle to the Late Miocene.

A new locality has recently been discovered in Western Crete where footprints of terrestrial mammals were exposed. The actual locality is situated near the village Vouves, to the west of the town of Chania. The ichnofossils come from lacustrine deposits that belong

to the Chatzi Formation. Two ichnotaxa are represented in the findings so far. The first and more impressive finding is a very well-defined footprint that can be related to a large-sized hyaenid (ichnofossil *Felipeda*). The second group of footprints are the traces of ruminant hoofs. More specifically the "hoof" traces belong to a large-sized ruminant. The hyaenid footprint (left manus) has a maximum anteroposterior diameter of 126 mm and a transverse diameter of 95 mm. It constitutes a cast where not only the imprint of the foot with the four fingers is well preserved, but also the full traces of the claws of all four fingers. This footprint can be considered as a new ichnospecies of the ichnogenus *Felipeda*. The age of nearby marine deposits of the Chatzi Formation is considered as Late Tortonian. Therefore, an equivalent age (Turolian) can also be inferred for the fossiliferous layer with the footprints. This is the first recorded case of footprint tracefossil findings from Neogene sedimentary deposits of Crete and Greece in general. In addition, these findings provide more evidence for the presence of well-established terrestrial environments and faunas in the area of Crete during the Late Miocene.

Anatomy, locomotion and constructional morphology of the polecat and the ferret (*Mustela putorius putorius* and *M. p. furo*, Mustelidae, Carnivora)

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Among Mustelinae, *Mustela putorius* has a very long trunk relative to its limbs. The ratio is even higher than those of the European species of the genus *Martes*. The muscular strength and the range of movement of the body of *Mustela* is high. The thorax is conically pointed and the trunk as a whole shows great flexibility. During stance and terrestrial locomotion, the trunk is mostly held in kyphosis, the degree of which can be actively controlled. In contrast to most publications on mustelid locomotion, but partly described by Horner and Biknevicius (2010), *Mustela* very often performs almost no or only slightly inchworm-like vertical oscillations of the thoracolumbar vertebral column during slow and medium gallop up to approximately 10 km/h. The flexible thorax is supported ventrally especially by the hydraulic effect of the contracted *m. pectoralis profundus*. For the *Mustela* construction, halfbound and bound are adequate types of gallop because the trunk then is braced against torsion caused by the bouncing forces. The strong front limbs play a major role in vertical climbing and subterranean locomotion in very low but wide tunnels. *Mustela* climbs vertical structures with a walk-like striding pattern with the vertebral column held straight. On horizontal or oblique substrates, the trunk is kept kyphotic. This kyphosis results in a high centre of mass. Thus, *Mustela* often fails in the attempt to move on substrates narrower than its body or in walking downwards head first on oblique substrates with an angle of more than 25° against the horizontal plane. If the substrate does not allow claw friction or if the individual is very massive, the hindlimbs, which are weakly muscularized compared to the front limbs, may fail to support the body mass. However, a mustelid-specific muscle, *m. atlantoscapularis dorsalis*, reinforces the neck – shoulder unit especially during crawling or climbing.

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The ontogeny of bone histology in the dwarfed island deer *Candiacervus* from the Late Pleistocene of Crete

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The Late Pleistocene deer *Candiacervus* Kuss, 1975 from the Mediterranean island of Crete is an outstanding example of insular dwarfism. The smallest morphotypes are characterized by a shortening of limb bones and a higher degree of bone fusions, being typical of island ruminants (Van der Geer *et al.*, 2006). A large amount of specimens of the second smallest morphotype, *Candiacervus* sp. II (De Vos, 1979) is represented by different ontogenetic stages in specimens from Liko Cave, Crete. Humeri, femora, and metatarsals of newborn, juvenile (one to two years old), and adult specimens have been sampled histologically. This is the first bone histological examination of an ontogenetic series of a dwarfed island deer.

In humeri, femora, and fused metatarsals III+IV of juveniles and adults growth marks are present. Ontoge-

netic changes are traceable throughout stylo- and autopodial development. However, large parts of the growth record in the primary cortex have been removed by remodeling and resorption. Humeri and femora of newborns start with fibro-lamellar bone and show a plexiform arrangement of vascular canals. In juveniles and adults, layers of secondarily deposited endosteal lamellar bone occur in the inner part of the cortex as well as areas of Haversian bone or pockets of secondary osteons. In adults, bone remodeling is strong, leading to large areas of dense Haversian bone in the inner cortex. Metatarsals of newborns show woven-fibred bone. During ontogeny woven-fibred bone is substituted by laminar or plexiform fibro-lamellar bone in the outer parts of the cortex. In the metatarsals of juveniles and adults, secondary deposition of lamellar bone is also found in the anterior region of the inner cortex. A full-grown metatarsal of the closely related continental *Megaloceros giganteus* shows a similar arrangement of bone tissue types as in *Candiacervus*. In both genera the amount of bone remodeling, i.e. the presence of Haversian bone, is highest in the posterior cortical regions of the fused metatarsals. In order to decipher adaptive patterns of bone tissue types in *Candiacervus* in comparison to its continental relatives, histological sampling of additional deer material is being conducted.

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Horn twisting versus bovid phylogeny: the "*Oioceros* complex" example

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Although the emergence of horns in bovids is correlated with the evolution of boundary patrol by territoral males, as a result of the Neogene global environmental changes (Janis, 1982), the horn morphology appears to have been weakly related to the environment but highly correlated to the body size, and animal's behavior (Lundrigan, 1996). Two of the most striking features of horns and consequently horn-cores are torsion and spiraling, altogether referred to as twisting.

Twisting appears as early as Middle Miocene in the fossil bovid records. Independent source of evidence suggest that torsion predates spiraling in an evolutionary scale. Both living and fossil bovids exhibit two types of spiraling/torsion: heteronymous (observed from base to top, the right horn/horn-core is anticlockwise twisted) and homonymous, albeit there is not yet reasonable functional or phylogenetic mechanism to explain these two opposite trends in horn development. Fossil evidence indicates, however that homonymous twisting appears earlier than heteronymous one. Heteronymous horn twisting is a highly convergent character repeatedly seen in several phylogenetically distinct living bovid lineages. Bovid taxa with homonymously twisted horns are much less frequent in the living record seen as a rule in Bovini, Alcelaphini, and Caprini. Even though all of them exhibit ramming as the predominant fighting behavior (Lundrigan, 1996), the mechanical respond towards homonymous horn twisting in Bovini/Alcelaphini and Caprini is distinct enough in order to suggest divergent evolutionary paths that might be phylogenetically constrained.

The origin of the "Caprini" type of homonymous twisting can be traced back to the Middle Miocene. A revision of the "*Oioceros* complex" of genera (Kostopoulos, submitted) allows recognizing several phylogenetic lineages and leads the partial restoration of the relationships between the three main groups of Neogene homonymous spiral-horned antelopes, i.e., Hypsodontinae, Oiocerini and Urmiatheriini.

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Greek Anthracotheriids: breaking up a 50-year silence

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Greek anthracotheriids are barely known by some sporadic findings presented during the 60's. Lüttig and Thenius (1961) in their pioneer work described a palate of the small bothriodont anthracotheriid *Elomeryx* Marsh, 1894 from Chandras, Greek Thrace. This specimen was later re-discussed by Hellmund (1991), who referred it to as *E. crispus crispus*. The 2009 reorganization of the collections of the Museum of Geology and Paleontology of the Aristotle University of Thessaloniki revealed some coal blocks including a few isolated upper and lower teeth of a single, old, male individual of *Elomeryx*. Although the sample lacks accompanying information about location and stratigraphy, a comparative study of the coal (Dr K. Christanis, in progress) indicates Moschopotamos (Katerini, Thermaikos Basin) as the most possible provenance.

The studied teeth are similar in overall morphology to *E. crispus*, but they do show some advanced features such as the compressed and distally serrated upper canine (Fig: median view; scale 2 cm), the vertical crest on the lingual cusp of P4, and the "Y" pattern on the posterior lobe of m3 that suggest a species intermediate between *E. crispus* and *E. borbonicus*. Additionally, the size of the studied molars indicates a species smaller than *E. borbonicus* and closer dimensionally to *E. crispus* or even to the smaller *E. cluai*. A second look at the Chandras palate shows the same morphological and evolutionary trends (i.e., continuous transverse valleys of m1/2).

Fossil evidence indicates that *Elomeryx* originated in Asia during the Middle Eocene and spread into Europe in the Upper Eocene (Ducrocq and Lihoreau, 2006). The Paleogene terrains of Thrace and adjacent area prove to be a key-area for the understanding of the genus' paleozoogeography and evolution.

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Walking like caterpillars, flying like bats – Pinniped locomotion

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The pinnipeds — seals (phocids), sea lions (otariids) and walruses (odobenids) — show different kinds of locomotion on land and under water. While otariids and odobenids can walk with their limbs held under their body like other mammals, the extremities of phocids cannot support the body on land. Therefore, phocids show a caterpillar-like movement with chest and pelvis as contact points with the ground. Because of this unusual locomotion mode these body regions are protected by muscles and blubber (i.e. connective tissue plus adipose cells) that act as shock absorbers. The land locomotion of otariids also shows some differences with other mammalian constructions. The lumbar vertebral column is flexed ventrally during locomotion as in sitting mammals. Apparently, because of the near-vertical orientation of the pelvis, otariids are unable to extend their hind limbs. The land locomotion of odobenids is not yet analysed. They are able to walk on all four limbs but always with their belly on the ground, presumably due to their large body mass. Therefore, an additional forward thrust is necessary. Whether or not the hind limbs of odobenids cannot be extended like those of otariids and whether or not the blubber and pectoral musculature also work as shock absorbers has still to be solved. The aquatic movement of phocids is a lateral undulation of body and hind limbs. Thereby one pes produces thrust with abduced spread toes while the other with adduced folded toes performs a recovery stroke. Because one

flipper at the time works as a functional unit with the body axis, the type of thrust generation is not really axial like in trout, but pseudoaxial with the power stroke of the pes at the very end of the body. This locomotion mode must have evolved from a paraxial paddling movement. A possible intermediate state is a pelvis-heavy construction like e.g. in beavers. Otariids produce thrust by using their front flippers for propulsion during underwater flight. A possible intermediate state from a terrestrial quadruped to the subaqueous flight of otariids is a shoulder-heavy construction like e.g. in polar bears. The odobenids combine both phocid and otariid swimming modes and often switch between the two suggesting an equal length of the limbs in the pre-construction. Probably the hind limbs were a little stronger, because the undulating propulsion is used more frequently. Observations have revealed that both swimming types in odobenids show small differences to the phocid and otariid locomotion modes, which may be essential for the interpretation of the odobenid evolution.

Evolution of autopodial rotation in Synapsida between the Permian and the Cretaceous

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The trunk of animals walking with abducted limbs and lateral undulation of the vertebral column passes around the fixed autopodium medially during the stride. During this motion autopodial rotation occurs: Either the entire autopodium rotates over the substrate in lateral direction (lateral or horizontal rotation) or the rotation against the substrate is compensated in the joints and during rolling. Hereby rotation and medial abduction in the digital joints occur.

Extant Lacertilia — and probably also the preconstructions of the Synapsida, which did not yet show a digital arcade — use their claws as anchoring points. During the rolling phase the digital joints are moved passively. The length of digits and metapodials in most cases increases until the autopodial ray IV, which facilitates the rolling movement in anteromedial direction. In Synapsida with a digital arcade the rolling movement happens in the distal heads of the metapodialia II-IV until the body weight is transferred to the distal part of the acropodium. Therefore, the length difference in the metapodialia II-IV mirrors the degree of autopodial rotation. The length of the digits, however, is nearly independent from the rolling mode, because their functional length can be actively changed by the flexion of the digital arcades.

In the digital joints the excursion angle of abduction and rotation increases with the degree of extension. The autopodial rotation therefore can be compensated with an increasing extension of the autopodial rays despite there was a coherent joint contact in the digital joints during most of the propulsion phase. Therefore Synapsida with digital arcades can transfer impulse forces through their digital joints. They are impulse walkers.

In Kannemeyeriiformes (Dicynodontia) and in Mesozoic Mammaliamorpha the length of the metapodialia is almost equal. In these forms the middle joint is or nearly is a hinge joint. The autopodium is then rolled in anterior direction almost without autopodial rotation. The decrease of autopodial rotation is aligned with the decrease of ab- and adduction of the limbs during walking. This can be achieved with a parasagittal limb position, like possibly in the Mesozoic Mammaliamorpha, or by generating propulsion only by rotation of the stylopodium without retraction and a zeugopodium, which is orientated rectangular to the stylopodium, as is probably the case in the front limbs of the Kannemeyeriiformes.

An archosaur-like paratympanic sinus system in the anomodont *Diictodon*

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The evolution of the mammalian middle ear is one of the best documented evolutionary events within Theriodontia. Nevertheless, the presence of a tympanic cavity and a tympanum in non-mammalian synapsids are still controversially discussed. An examination of a skull of the anomodont *Diictodon* by neutron tomography revealed paratympanic sinuses in the bones forming the brain cavity and the occipital region, in the quadrates and the lower jaw. Probably, the mandibular sinus was connected to the cavity in the quadrate by a syphonium similar to the one crocodilians have (Witmer and Ridgely, 2008). As paratympanic sinuses derive from the middle ear sac (Witmer, 1997) a tympanic cavity in the otic region of *Diictodon* can be suggested. Paratympanic sinuses decrease the

compliance of the middle ear, increase the sensitivity to low frequency sound, contribute to sound localisation (Witmer, 1997) and act as Helmholtz resonators (Dufeau and Witmer, 2010). Consequently, anomodonts must have had a well-developed acoustic apparatus as crocodilians have and presumably were able to hear both ground- and airborne sounds. Sound was probably perceived by skin and bones of the lower jaw and either transmitted via articular and quadrate and/or via the hyoid apparatus to the stapes. Time differences in sound perception between the two acoustically independent caudal parts of the mandible would have allowed *Diictodon* to localise a sound source.

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New vertebrate-bearing localities from the Triassic of Thailand

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Despite thirty years of fossil vertebrate excavation in Thailand, reports of vertebrate fossils from the Triassic are not as extensive as those from the Early Cretaceous. Recent field survey in North-Eastern Thailand by the Palaeontological Research and Education Centre (PRC) identified two vertebrate fossils localities in Chaiyaphum Province, Huai Hin Lat Formation, Late Triassic. First, the Huai Nam Aun locality yielded a new record of shark teeth assigned to the genus *Hybodus*, bony fish scales, postcranial elements of a single large specimen of temnospondyl amphibian as well as numerous coprolites. The whole assemblage has been preserved in alternating beds of mudstone and clay stone. The second locality, Huai Pha Phueng, presents rather complete bony fish specimens, teeth of phytosaurs and osteoderms of crocodiles, which are under detailed study.

Dinosaur Valley of Thailand: The spectacular vertebrate fossil sites in Southeast Asia

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The Thai Khorat Group, northeastern part of Thailand, has yielded a succession of non-marine fossil vertebrates such as dinosaurs, pterosaurs, crocodiles, turtles, bony fishes and sharks. These vertebrate remains are mostly collected from three formations, the Phu Kradung (Late Jurassic to Early Cretaceous), Sao Khua (Berriasian – Berremian), and Khok Kruat (Aptian – Albian) formations (Buffetaut and Ingavat 1985; Buffetaut and Suteethorn 1999; Tong *et al*., 2003; Cavin *et al*., 2004; Lauprasert *et al*., 2007, 2009). At present, we focus only on the fossil localities found in the Phu Phan Mountain Range, which lies in the northwest-southeast direction and separates the Khorat Plateau into two basins, i.e. Sakon Nakhon basin and Khorat basin. As a good example, a site that shows the great potential of palaeontological research in the Phu Phan Mountain Range is Phu Noi in Kalasin province. Almost five hundred dinosaur specimens have been discovered here, as well as several more in neighbouring areas. This is the reason why we decided to use the name "Dinosaur Valley" for all excavation sites in the Phu Phan Mountain Range.

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A giant sauropod from the Barremian of France

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Excavations in 2010 near Angeac-Charente in Charente (between Cognac and Angoulême, south-western France) have revealed a very rich dinosaur bone bed of Early Cretaceous age (Hauterivian – Barremian). Sauropods are known from teeth, several limb bones and caudal vertebrae of very large size; it is not clear whether this material which was found from several points of the quarry (reworked in recent alluvia or in situ in Cretaceous strata) represents a single taxon. What can be said is that the teeth are reminiscent of *Turiasaurus riodevensis* Royo-Torres *et al*., 2006, a Tithonian – Berriasian taxon from the Villar del Arzobispo Formation from Teruel in Spain. However, this kind of heart-shaped spatulate teeth is known from various Jurassic and Early Cretaceous localities in Europe (see for example the teeth of *Neosodon* illustrated by Buffetaut and Martin, 1993). It can be noted that *Turiasaurus* is supposed to have strongly opisthocoelous caudal vertebrae (as far as the single caudal vertebra referred to it by Royo-Torres *et al*. (2006) indeed does belong to this animal). The caudal vertebrae from Angeac are procoelous (anterior caudals) or amphiplatyan (middle caudals) and thus strongly differ from *Turiasaurus*. They share many characters with another partially known Spanish sauropod, namely the Early Aptian *Tastavinsaurus sanzi* Canudo *et al*., 2008, also found in Teruel, the teeth of which are still unknown. The most spectacular discovery in Angeac is unquestionably that of a 2.34 metres long femur, the longest known in the world to our knowledge. It can be noted that both *Tastavinsaurus* and *Turiasaurus* are considered as non-Titanosauriformes sauropods (Royo-Torres *et al*., 2006; Royo-Torres, 2009).

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The Palaeobiogeography of Cretaceous Pachycormiformes

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The recent identification of pachycormiform material from a variety of global localities has caused a reas-

sessment of the significance of this group. Although there are still biases that skew the picture, an increasing number of Gondwanan occurrences (e.g. the Turonian of Mexico, the Aptian of Colombia, the Albian of Australia) have made the palaeogeographical picture increasingly clear, and begun to balance what had been emphatically an Early-Middle Jurassic European signal for a century and a half. From tusked agile 'proto-barracuda' predators to a dynasty of large-bodied suspension feeders, this group was as diverse as it was successful throughout the Mesozoic.

First eat and then think: the relation between craniodental and neuroanatomical changes in carnivoran evolution

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Some Carnivora lineages evolved large size and particular craniodental characters (e.g. deep jaws, large canine and incisor teeth, reduced molar grinding areas), which allowed them to prey on large-bodied animals. Despite the extensive modifications of their craniodental anatomy, their brain retained the same degree of fissuration as seen in their ancestors (Lyras, 2009). Such cases of stasis can be noted in canids, mustelids, felids and nimravids. This evolutionary stasis is because of energetic constraints. Carnivores prey on large animals in order to expend less energy during predation. Since the neural tissue is energetically one of the most expensive tissues, the advancement of the brain could be too costly to take place. Therefore, although there is a general selective pressure towards the development of complex brains, in these cases the development of teeth and skulls was of higher priority.

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Hard hitters? A kinetic/dynamic look at stegosaur tails

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The morphology of stegosaur tails suggests they were used as weapons in interspecific and intraspecific combat. Previous studies either did not detail the range of motion and the kinetics and dynamics of tail motions (e.g., Hennig, 1925; Janensch, 1925), or used much simplified physics-based calculations (e.g., Carpenter *et al*., 2005; Arbour, 2011), sometimes with significant errors in the equations and measurements. On the basis of high-resolution laser scans of the lectotype (Mallison, 2011) and other well preserved material of the small African stegosaur *Kentrosaurus aethiopicus* Hennig, 1915 a CAD model was created, based on comparison with extant animals. These comparisons highlighted that most reconstructions suffer from vastly insufficient musculature volumes in the tail. A detailed kinetic/dynamic modeling of the tail motions indicates that its tail was a formidable weapon, easily capable of delivering debilitating, if not lethal, impacts on predators of all sizes, across a large portion of its significant motion range. The most likely impact scenario, blunt impacts, likely created mainly soft tissue trauma, as well as deformation-related fractures of thin bones close to the surface (facial bones, ribs), whereas steep impact angles probably led to deep penetrating trauma, resulting in crushing of superficial and deeply located bones and soft tissues. Such injuries were probably often fatal, and a fossil example has been found in the form of a crushed anterior caudal of an allosaurid theropod (Carpenter *et al*., 2005).

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Contribution to the study of the effect of chemical conservative means on the microstructure of fossilized bones

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The objective of this presentation is to present the results concerning the behavior of fossilized bone under the influence of specific chemical means of conservation that have been used on such material for decades. The fossilized material used includes fossil bone parts from two different fossiliferous sites in Greece: Tilos Island (Dodecanese) and Kerassia (Euboea Island).

The chemicals chosen for this experimental study are hydrogen peroxide (perhydrol), acetic acid and formic acid, as these are some of the most common chemical conservation materials used with fossils till this day, mainly during the removal of the surrounding material (Lindsay, 1995). In order to conclude on the extent of damage caused to the bone microstructure by the different chemicals and also possibly suggest their optimum use so as to avoid it, numerous experiments were realized. In each of these, samples from both sites were exposed to different combinations of parameters such as the type and concentration of chemical and the duration of exposure. The methodology applied includes the detailed observation of microstructure through Scanning Electron Microscopy (SEM) and the qualitative chemical analysis by X-ray microanalysis (EDXA) (Child, 1995; Fernández-Jalvo and Marín Monfort, 2008).

From the results of this study, it is obvious that the material's initial condition seems to be the most important parameter when deciding on the type of conservative mean.

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Myological adaptations to fast enduring flight in European free-tailed bats, *Tadarida teniotis* (Rafinesque, 1814)

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Molossids are a family of highly specialized bats that have evolved structural adaptations in the forelimb associated with fast, enduring, and long-distance flights within uncluttered environments. The present study aims to investigate any modifications in selected muscles of the European free-tailed bat, *Tadarida teniotis* involved in the upstroke/downstroke of the shoulder region, flexion/extension of the elbow and wrist joints, and tension of the patagium that could be associated to such flight patterns. For these reasons, we calculated standard external ecomorphological indices (AR, Q, Itip) and applied gross anatomical dissections on six adult specimens from northern Greece in order to qualitatively (origin, arrangement, insertion) and quantitatively (muscle weight fractions, PCSA) examine any patterns of mechanical advantage and relative muscular development and strength.

In terms of forelimb anatomy, the species was characterized by: (i) well-developed wing adductors (*mm. pectorales*) and a significantly enlarged and powerful *m. subscapularis*, (ii) a reduced qualitative and quantitative differentiation among upstroke muscles with the *m. spinodeltoideus* dominating over the other parts of the deltoid group, (iii) shared development of elbow joint flexors and extensors, (iv) the apomorphic enlargement of the coracoid head of *m. biceps brachii*, and (v) the presence of patagial muscles (*mm. humeropatagialis*, *tensor plagiopatagii*) unique to molossids, along with the enlargement and empowerment of the other patagial muscles (*mm. occipitopolicallis, coracocutaneus*).

This suite of characters, may generate a powerful and controlled downstroke at the shoulder, keep the elbow balanced, the distal forelimb in extension, and the wing membrane under controlled tension and ultimately contribute to the fast, steady, non-manouverable and agile flight of the species.

The matrix: detailed reevaluation of a large dataset demonstrates support for the "lepospondyl hypothesis" of the origin of Lissamphibia

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The origin of the modern amphibians (Salientia, Caudata, Gymnophionomorpha, and Albanerpetontidae) is one of the greatest remaining mysteries in vertebrate phylogenetics. These animals could form a clade (Lissamphibia), which could be nested among 1) the Permo-Carboniferous temnospondyls ("temnospondyl hypothesis", TH) or 2) the coeval lepospondyls ("lepospondyl hypothesis", LH); alternatively, 3) the frogs (Salientia) and the salamanders (Caudata) could stem from two groups of temnospondyls while the caecilians (Gymnophionomorpha) would be lepospondyls ("polyphyly hypothesis", PH). The largest data matrix for this question was published by Ruta and Coates (2007), who found the TH to be most parsimonious, while the LH required nine more steps and the PH twenty-seven more. Building on Chapter V of Germain (2008), we have compared thousands of cells in this matrix to the descriptive literature and to specimens, merged many correlated characters, tried to account for the effects of ontogeny on phylogenetics, and ordered potentially continuous characters. (An early, incomplete version of this work forms Chapter 5 of Marjanović (2010)). We find the LH to be most parsimonious, with the TH currently requiring eleven and the PH twelve more steps. When we add eleven taxa to the matrix, including *Gerobatrachus* (expected to bolster the PH: Anderson *et al*., 2008), these differences between the hypotheses do not change. We review selected characters that were thought to support any of the three hypotheses.

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A new taxonomy to accommodate *Gelocus quercyi* (Ruminantia, Mammalia), and its relationship with *Prodremotherium elongatum*

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The reassessment of *Gelocus quercyi* Jehenne, 1987, from the old collections from the Quercy (France) and the description of new material from several well-dated localities in France and Switzerland allow for a new interpretation of this species. The presence of a large cingulum on the upper molars and the elongated lower premolars are considered primitive features. However, it also possesses selenodont cusps with elongated crests and the metaconule is well-developed giving a quadratic shape to the upper molars. The molars possess a well-developed metastylid. The p1 seems to be lacking. This is not seen in *Gelocus*, and we propose here to move *G. quercyi* to a new genus. In the referred material, there is one maxillary with clearly more bunodont and triangular molars due to the reduction of the metaconule. This feature is typical for *Gelocus* and could explain the species' original attribution to this genus. The distinctive characteristics of *G. quercyi* are shared with the latest Middle Eocene genus *Notomeryx* and the latest Oligocene species *Prodremotherium elongatum*.

As suggested by many authors, *Prodremotherium* should not be considered a Gelocidae *sensu stricto*. As we show, it shares important characters with *G. quercyi*. Furthermore, *Dremotherium* did not evolve from *Prodremotherium*. 80% of *D. guthi* (latest Oligocene) described by Jehenne (1987) possess a p1, which is lost in most *D. feignouxi* (Early Miocene). This tooth is already lost in all observed specimens of *P. elongatum*. The saber-toothed canine of *Dremotherium* clearly differs from the tragulid-type of *Prodremotherium*. The metapodial bone presents different stages of fusion. These characteristics, and others, show that *Prodremotherium* belongs to a distinct lineage than *Dremo-*

therium and cannot be its ancestor as suggested by its name.

We propose to ascribe the new genus, *P. elongatum*, and *Notomeryx* to a new family which presents a modular evolution and is a sister group of the Eupecora. The presence of *G. quercyi* and *P. elongatum* in well-dated localities permits to assess the biostratigraphic ranges of this new family in Europe. The family, already present in Asia during the Eocene, appeared during MP25 in Europe with *G. quercyi*, coinciding with the extinction of the Gelocidae. This species, inhabiting woodland as deduced from its postcranial remains, is succeeded by the more open area species *P. elongatum*, which is restricted to MP28. These time intervals correspond to the major climate events of the Oligocene: the glaciations Oi2, Oi2c, and the Late Oligocene Warming.

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Oxygen and carbon isotope compositions of extinct bovids and environments of primates in the Late Miocene of Greece

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This study explores the environmental changes that potentially could explain the replacement of great apes by monkeys during the late Miocene along the Axios River, Greece (Koufos, 2006). Two fossil-rich sites encompass the considered time frame: the ape-bearing (*Ouranopithecus*) "Ravin de la Pluie" (RPl) and the monkey-bearing (*Mesopithecus*) "Ravin des Zouaves-5" (RZO) localities. Combining enamel carbon with phosphate oxygen isotopic analyses of 32 bovid remains allows the identification of dietary habits (Cerling and Harris, 1999) and the sources of absorbed waters (Bryant *et al*., 1996) for the antelopes and therefore of environmental changes. δ^{18}Op ranges from 13.7 to 21.3 ‰ for RPl bovids and from 14.3 to 21.4 ‰ (vs. V-SMOW) for RZO ones. Although body mass is known to control oxygen isotope fractionation between body skeleton and water, additional factors must explain such high within-site differences (Langlois *et al.,* 2003). Among them, the availability of various water sources with different oxygen isotope composition in combination with physiological and ecological factors could have resulted in significant isotopic variations amongst sympatric antelopes. The δ^{13}Ce values of extinct bovids are not different from both C_3 grazers and browsers, even though they are lower than those measured for extant C_4 grazers. The variations in δ^{13}C between the bovids from the two sites could reflect more intakes on C_3 xeric plants for the RPl antelopes. Such outcomes are also supported by dental microwear analyses (Merceron *et al*., 2010).

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Ichnological evidence of taphonomic feedback in vertebrates. Examples from the Late Jurassic and Cretaceous

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Unravelling taphonomic histories has long been one of

the primary steps in palaeoeocological studies. Moreover, in order to understand the origin of past vertebrate assemblages the taphonomic overprint has to be recognized. We present here two examples that help to understand and clarifiy some aspects of vertebrate taphonomy and sedimentology that are usually not evident in the fossil record.

The first example comes from the Swiss Late Jurassic Solothurn Turtle Limestone, a marginal marine lagoonal environment that has long been known for its high diversity of marine cryptodiran and pleurodiran turtles (e.g. Meyer, 1994). Out of a large collection, only very few specimens of carapaces display areas that are more or less densely covered by stellate v-shaped grooves. These are attributed to the ichnotaxon *Gnathichnus pentax* Bromley and are interpreted as gnawing and rasping traces of the teeth of hemicidaroid sea urchins. Furthermore, plastra and distarticulated turtle remains serve as substrate for the settlement and growth of small epibenthic oysters. From the grazing traces the presence of a post mortem algal cover can be inferred that would not leave any trace in the fossil record. The size of the epibenthic oysters on the turtle remains restrict the sediment water interface resident time to probably less than five years before final burial. The presence of trace fossils in combination with taphonomic feedback helps to understand the formation of this lagerstatten and elucidates the amount of time averaging.

The other example comes from the Campanian Cerro del Pueblo Formation of southern Coahuila (Mexico) that is widely known for its terrestrial vertebrate community in deltaic coastal setting (Eberth, 2004). During our ichnological field study in March 2006 (Meyer *et al*., 2008), we did some campsite collecting in the evening and found disarticulated titanosaur material. Several titanosaur rib fragments showed unusual borings. These clavate perforations are found all around the bones and contain in some cases the producer itself. The borings are attributed to the ichnotaxon *Gastrochaenolites* left by marine bivalves (e.g. Tapanila *et al*., 2004). Moreover, the circumferential perforations show different size ranges. This cannot be explained by a simple model where the ribs were colonized during their resident time at the sediment water interface and by subsequent turning over by currents. Another scenario has to be evoked: The carcasses of the titanosaurs were buried in their natural deltaic habitat and partly excavated by a subsequent marine transgression that made some of the bones sticking out of the sediment. This allowed an all around settlement of molluscan larvae followed by boring into the hard substrate. This observation supports the sedimentological evidence of a marine transgression that is also corroborated by the presence of ammonites and shark remains.

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First recorded presence of a bird of prey from the Late Miocene of Pikermi (Attica, Greece); preliminary observations

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Late Miocene avian remains in Greece are rather rare, known only from five localities: Pikermi (Attica), Chomateri (Attica), Samos, Kerassiá-4 (Euboea) and Perivolaki (Thessaly). Among these, Pikermi preserves a relatively rich palaeoavifauna, both in terms of taxonomic diversity and number of specimens. By common consent, the avian taxa recognized in Pikermi are: *Struthio karatheodoris*, *Ciconia gaudryi*, *Grus pentelici* and *Pavo archiaci*. Moreover, *Phoenicopterus* sp. and *Pavo bravardi* have also been added by Mlíkovský (2002) and Boev and Koufos (2006), respectively. As

no information is provided for the skeletal elements on which the specific determination of the latter two taxa is based, their taxonomic status should be treated with caution. In the present presentation emphasis is placed on a fragmentary distal ulna from Pikermi, already allocated to *Gyps* sp. by Michailidis *et al*. (2010). The morphology of this specimen demarcates it from previously described Pikermi avian taxa and point to a species with falconiform affinities. Its size is marginally smaller than *Haliaeetus albicilla* and *Aquila heliaca* specimens examined. However, in terms of its detailed anatomical features, it is most similar to the larger sized *Gyps fulvus*. Extant vultures occur primarily in relatively open environments that can sustain large numbers of herbivores and therefore a large supply of exposed carcasses which is vital for their survival. The Pikermi *Gyps* sp. indicates that similar conditions must have been met in the Late Miocene of Pikermi.

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Emergency excavation in the Grube Unterfeld (Frauenweiler) clay pit (Oligocene, Rupelian; Baden-Württemberg, S. Germany): New records and palaeoenvironmental information

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The Grube Unterfeld (Frauenweiler) clay pit has become famous for a well-preserved and highly diverse vertebrate and invertebrate fauna, which dates back to the Rupelian stage of the Oligocene (32 MYA). It was closed down for some years and became almost completely backfilled in recent times. For an emergency excavation, which was granted by the National Geographic Society, an area of almost 450 m^2 has been exposed from a three-metre overlay of building rubble and ground excavation materials. A total of 1932 fossils were found, of which 1865 could be accurately calibrated and documented in the field book. In all, 67 specimens were recovered for the palaeontological collection of the Hessisches Landesmuseum Darmstadt. For the first time, a precise documentation of the relative frequencies of different preservational stages in well-defined stratigraphical layers was achieved. The taxonomic spectrum is clearly dominated by small herrings (cf. *Sardinella* Cuvier et Valenciennes, 1847), followed by shrimpfish (*Aeoliscus* Jordan et Starks, 1902) and basking shark remains (*Cetorhinus parvus* Leriche, 1910). The project furthermore yielded a number of striking new fossils. There was a complete sirenian (cf. *Halitherium schinzii* Kaup, 1838), a tody-bird (*Palaeotodus itardiensis* Mourer-Chauviré, 1985), and a cheloniid turtle, which may belong to the genus *Glarichelys* Zangerl, 1958. Amongst the fishes, the first articulated specimen of a basking shark worldwide was found. The percoids (Perciformes) are probably represented by a completely new taxon. In addition, there are new records of rare trumpet fishes (Aulostomidae) and snake mackerels (Gempylidae). The composition of the fish fauna clearly differs from the one that was known from the results of earlier excavations. It indicates shallower waters with clearer references to warmth-loving Indo-Pacific faunal elements. This corresponds rather well with the occurrence of nanoplankton blooms. However, there is some contradiction with mass occurrences of certain foraminiferans, which suggest a deeper, more offshore environment. Upwelling events may occasionally have transported masses of juvenile foraminiferans in shallower areas, rather than an opposite transport of fragile fish skeletons and coccoliths into a deeper basin.

A new form of *Pseudoloris* (Omomyidae, Primates) from the Middle Eocene of the Almazán Basin (Iberian Peninsula)

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The extinct family Omomyidae (Primates) has a great scientific interest due to its still unresolved relationships with other members of the order, particularly

anthropoids. The subfamily Microchoerinae is known exclusively from the Eocene of Europe, with some exceptions lasting into the Oligocene. *Pseudoloris* is a very small microchoerine identified in some localities of Spain, France and Germany. Its remains are relatively scarce; therefore the knowledge of its dental morphology, evolution and ecological requirements is far from being complete.

Here we report the existence of a new form of *Pseudoloris* from the middle Eocene (MP15-16, Robiacian) site of Mazaterón (Almazán Basin, Spain). The material consists of 22 isolated teeth, and is characterized by its medium size, high and thick paracristid and absence of a distinct paraconid in the lower molars, large hypoconulid in the m3, well-developed protocone in the P3 and P4, reduced hypocone and presence of a weak postprotocingulum in the M1-2, and especially by the i1, with a bucco-lingually enlarged crown and a very wide, antero-posteriorly compressed root. In fact, the most remarkable difference between this new form and *Pseudoloris parvulus* and *P. pyrenaicus* (the only two species of the genus whose anterior dentition has been described) is the much larger and robust lower incisor.

This finding represents the first Microchoerinae from the Western Iberian Bioprovince, and the westernmost record of the genus known up to now. Moreover, this form is clearly different from the species of *Pseudoloris* found in the middle and upper Eocene in the Pyrenean basins (*P. isabenae* from Capella, *P. parvulus* from Sossís and the recently described *P. pyrenaicus* from Sant Jaume de Frontanyà). Thus, further investigations on the material from Mazaterón, most probably leading to the formal description of a new species, could reinforce the endemic nature of the mammal faunas from this bioprovince, already observed in other groups such as rodents and perissodactyls, and also evidenced in adapoid primates, with the recent description of the genus *Mazateronodon* from the same locality.

The effect of tectonic movements and eustatic fluctuations on the immigration of Pleistocene mammals in the South Aegean Sea

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The initiation of the extension in the Aegean Sea was a consequence of the extrusion of Anatolia away from Eurasia and Africa. During the last 12-11 million years the sea intruded into the region of Aegeis and caused its subdivision due to the rollback of the Hellenic Arc. As a result, the combination of tectonic movements and pressures are evidently responsible for the formation of the Hellenic arc. Moreover, the successive Glacial and Interglacial cycles during the last 800.000 years, regulated by Millankovitch cycles, caused changes in the global sea levels and the allocation of land and sea. Thus, tectonic movements and eustatic fluctuations are responsible for the changes in the South Aegean Sea during the last 800.000 years. These sea level fluctuations influenced the distribution of herbivore mammals that moved from continental areas to islands. Animals that were competent swimmers such as elephants, deer, and hippopotamuses were able to cross sea channels that were located in close vicinity due to accidental circumstances. The elaboration of information about known faults in the South Aegean with the program ArcGIS and their comparison with the isobath lines of –50, –100 and –150 m gave important information about the possible routes these mammals followed. They were able to cross from the Greek mainland to islands such as the Cyclades, Crete, and from Asia Minor to Dodecanese and the islands of the East Aegean Sea. Competition, limited space, and periods with lack of food pushed the large forms to dwarfism. On the contrary, smaller forms became giants due to lack of competition and fewer hunters. As a consequence, many Pleistocene endemic species evolved in the South Aegean. *Mammuthus creticus*, *Elephas tiliensis*, *E. creutzburgi*, *Hippopotamus creutzburgi*, *Candiacervus ropalophorus* are some examples of such species from Crete and Tilos whose ancestors had immigrated in search of food and new habitats.

Backward, forward or completely different: wing sweep in pterosaurs

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In the past the flight configuration of pterosaurs, especially concerning the expansion of the flight membranes was discussed controversially, but with the latest soft tissue specimens it seems to be certain that

the trailing edge of the brachiopatagium extended from the tip of the wing finger to the ankle joint. However, the position of the bony wing spars in flight position remains speculative until now, because most of the complete specimens are preserved with a semi-folded wing and incomplete membranes. A hitherto undescribed specimen of *Rhamphorhynchus* from Solnhofen is so completely preserved that it was possible to measure the exact length of the trailing edge of the brachiopatagium and thus to obtain a measure for the distance between the tip of the wing finger and the ankle. Until now, the assumed standard flight configuration with the wing finger nearly rectangular and the lower leg parallel to the longitudinal axis of the body is only possible if a minimum elasticity of 10% along the trailing edge is postulated. However, the taphonomy of pterosaurs suggests that it is more likely that the flight membrane had no or only a little elasticity. In this case the flight configuration shows a backward swept wing with abducted hind legs (Fig. 1A). This configuration strikingly resembles a flying wing, the glider Ho II, which was built and successfully flown in 1935 (Fig. 1 B). With such a flight configuration in *Rhamphorhynchus* the uropatagium could have acted as an elevator, steered with the fifth toe.

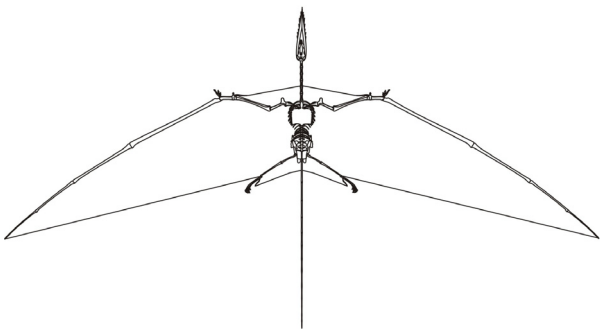

Fig. 1A: *Rhamphorhynchus* in flight position

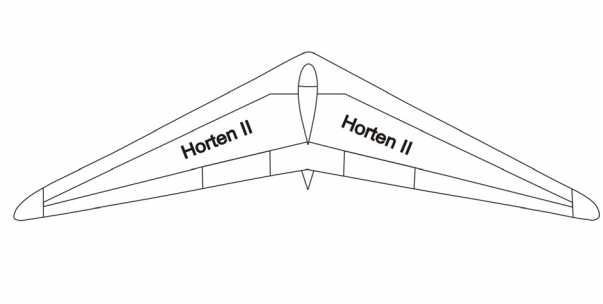

Fig. 1B: The glider Ho II

Temporal evolution and biogeography of Miocene large Castoridae (Mammalia, Rodentia)

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Miocene beavers were a diverse rodent group in the Holarctic region, many of them being more terrestrial and with smaller bodysize than the semiaquatic extant *Castor*. The fossil record of large beavers is rather scarce in the Miocene, but new findings have shed light on these rather enigmatic rodents. Most of them can be attributed to the Early to Middle Miocene subfamily Anchitheriomyinae. With their complex, *Hystrix*-like cheek tooth pattern and low condyle, their mandibles appear similar to those of Old World porcupines, Hystricidae (Koenigswald and Mörs, 2001; Stefen and Mörs, 2008). The largest Early Miocene representative is the European species *Anchitheriomys suevicus*, known from Germany, France and Switzerland. The Middle Miocene species *Amblycastor fluminis* is widely distributed in North America and is known from Nebraska, Colorado, Nevada, Georgia and Florida. *Amblycastor* is larger and more derived than *Anchitheriomys* (Mörs and Hulbert, 2010). The taxonomic status and biogeographic relation of the Asian anchitheriomyine from Tunggur in Mongolia remains unclear, due to the scarce material. The origin of the lineage is unclear as well; smaller and more primitive anchitheriomyines have been described from the Late Oligocene and Early Miocene of Nebraska, and there are contemporaneous beavers with complex tooth morphology known from Central Asia, e.g. Kazakhstan. The best material — in terms of specimen numbers and preservation — of a primitive anchitheriomyine beaver comes from the Early Miocene of central Japan (Mörs and Tomida, in prep.). This new taxon is endemic to Japan, but shows a biogeographic link to North America. The largest Miocene castorid is *Youngofiber sinensis*, a giant castoroidine beaver first described from the Early Miocene of Sihong in the Jangsu Province, China. Outside East China, the species is only known from the Early Miocene of central and western Japan. *Youngofiber sinensis* seems to be an endemic East Asian species.

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A new fossil of *Cuora* from the Miocene of Thailand sheds new light on the origin of Asian box turtles

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Box turtles are turtles with a hinged plastron allowing themselves to tightly close their shell to protect themselves from predators. In Asia, they are represented by the genus *Cuora* that contains around ten living species. The systematics and evolution of this genus has been clarified recently on the basis of DNA data. By contrast, the fossil record of this genus is not well documented: it is restricted to the late Neogene, and is so far only known from a few fossils in China and Japan, while today the genus extends until peninsular Southeast Asia and Indonesia. Here we report the oldest occurrence of this genus in the Chiang Muan Mine in Phayao Province (Northern Thailand). This locality has yielded a rich fossil vertebrate assemblage dated to the Middle Miocene. On the basis of the presence of a distinct plastral hinge, hexagonal neural plates with short postero-lateral sides, and round posterior plastral lobe, a partial shell can clearly be assigned to the genus *Cuora* within the Geoemydidae. The presence of *Cuora* indicates the earliest record of the genus in the Middle Miocene and documents the evolutionary history of Asian box turtles. However, the fossil does not exhibit an intermediate morphology between box-turtles and can not be seen as a missing link with the closest sister group of Asian box turtles.

The morphology and early evolution of the avian sternum

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The presence of an ossified sternum is highly variable among basal birds and closely related non-avian theropod dinosaurs. A sternum is absent in every known specimen of the most basal bird, *Archaeopteryx*, and non-ornithuromorph birds lack many features of this element often associated with flight (i.e. large keel), raising fundamental questions about the flight mechanics in basal taxa. Across Mesozoic Aves, and among their closely related non-avian dinosaurian relatives, the wide range of known morphologies hints at the evolutionary history of the development of the modern sternum. We review the preserved sterna of Mesozoic birds and their close dinosaurian relatives and discuss the likely sequence of sternal ossification. From the inferred phylogenetic positions of taxa with known sternal morphologies, we can hypothesize the sequence in which the presence of ossified sternal Anlage evolved within Aves. The fossil record of enantiornithines is complete enough for us to hypothesize a generalized ossification pattern that was likely unique to this clade. Although many features of the adult avian sternum are considered homologous between clades, the Anlage from which some features ossify in enantiornithines must have differed greatly from that seen in living birds. Comparison to the known development of the sternum in living birds suggests that both ossification patterns and the diverse morphologies of this element seen in neornithines evolved within the crown clade of Aves. Nevertheless, the basic shape of the modern avian sternum was present by the Late Cretaceous, with Early Cretaceous ornithurines possessing nearly modern morphologies.

The evolution of jaw mechanism and oral food processing in heterodont crocodyliforms

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Recent discoveries of crocodyliforms especially in the Cretaceous of South America and Africa revealed complex, heterodont dentition sometimes including multicusped teeth, and well-controlled dental occlusion along with a complex jaw mechanism in all main lineages of the Crocodyliformes (Protosuchia, Notosuchia, Neosuchia). Besides cranial and dental morphology, the details of the wear facets, jaw joint and symphysis construction and reconstruction of the jaw adductors are key characters to understand the process of dental occlusion, the phases of jaw mechanism and oral food processing.

Study of these features in twenty extinct and one extant species of heterodont crocodyliforms indicates that at least four different types of jaw mechanism appeared, some of them more than once independently among the clades of the group. As in most crocodyliforms, heterodont protosuchians and more developed globidont forms are characterized by a simple, orthal jaw closure without any significant antero-posterior or latero-medial mandibular movement. In these forms, quadrate condyles precisely fit in the usually highly positioned jaw joint, and pterygoid muscles are particularly developed. Dental wear analysis revealed that antero-posterior (pro-palinal) mandibular movement described in various notosuchians actually covers two completely different mandibular movements. In forms with proal movement dental wear occurs on the carinae and apically, and advanced pterygoid muscles were developed to motorise the forward shifting of the mandibles during jaw closure. In palinal movement, dental wear of the lower teeth are mainly labial, pterygoid muscles are reduced, external adductors are extremly developed to produce retractive powerstoke, in some cases with alternate dental occlusion. In the fourth type orthal movement is combined with significant latero-medial movement revealed in the hylaeochampsid *Iharkutosuchus*.

The evolution and diversity of complex jaw mechanisms and effective oral food processing in crocodyliforms strongly resembles those of the masticatory system of mammals and suggest that the diverse niches filled in dominantly by mammalian groups in North America and Asia were occupied in other Mesozoic ecosystems (e.g. in numerous Gondwanan habitats or on some islands of the European archipelago) by highly specialized crocodyliforms.

Faunal dynamics during the last 5 Ma: a case study of large mammals from the Western Mediterranean region

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The multifaceted evolutionary history of mammals, which led to the present-day biodiversity and biogeographical settings, undoubtedly mingles with those of palaeogeographical, climatic and environmental changes experienced by our planet. The last 5 Ma, particularly the Quaternary period, seem to be especially appropriate to investigate as to the actual impact that long term and rhythmic/periodic cycles —as well as the increased potential for isolation of populations due to environmental fragmentation and multiple rearrangement of climatic zones— had on evolution, dispersal and extinction of taxa and on dynamics of mammalian faunas. Throughout the Pliocene – Pleistocene, large mammals, particularly from middle latitudes, are known to have frequently reacted to climate shifts by varying their range. This in keeping with the vegetational cover, latitudinal displacement of biomes, and changes in palaeogeographical setting relate to both tectonics and climate forcing. The Mediterranean basin, with its exceptionally rich Plio-Quaternary fossil record, its complex physiography, climatic heterogeneity, presence of important geographical and ecological barriers seems to be particularly appropriate for analyzing and comparing faunal dynamics as changes in taxonomical composition and diversity at local and regional scales. The Mediterranean region experienced a long and complex history of species turnover, invasions, and competitive exclusion, as well as the origination of endemic species and prolonged survivals of some taxa in refugial areas. Turnover pulses and first/last appearances discrete bioevents (local evolution, dispersal, extinction) —which was regionally sometimes synchronous but often diachronous— led to a progressive reconstruction of mammalian faunal complexes that came to an end with the so-called megafaunal extinctions.

The micromammals from Minoan Crete: human intervention in the ecosystem of the island

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The present paper will present data on the commensal *Mus musculus domesticus* from Bronze Age Crete and will try to investigate the ways the marine states of the Minoan period helped in the spread of the house mouse on the Aegean islands. Additionally, possible origins of the Bronze Age house mice will be tracked through the results of geometric morphometric analysis on lower first molars. Finally, the role played by man in the change of the microenvironment within and around settlements by the introduction of commensals will be discussed through comparisons between the endemic or local species and the house mouse, due to the arrival of which the former were eliminated or vanished.

A new species of *Platypterygius* or a morphological variation? The difficulty to designate a new species, when the record fossil is scarce

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The Tyndall Glacier in the Torres del Paine National Park is an extremely fossiliferous area of the Chilean Patagonia. In this area numerous articulated and a few complete ichthyosaurs were found. Most individuals are adults and juveniles. However, a few neonates and females with embryos also occur. The ichthyosaur skeletons are associated with abundant belemnites, ammonites and inoceramid bivalves. Ganoid and teleost fishes are frequently found. The record of tree trunks and remains of land plants suggest an environment in close vicinity to the shore.

The meltdown of Tyndall Glacier has exposed sedimentary rocks in an area of about 10 km^2, which are part of the Zapata Formation (?145–99 Ma). During the field campaign of 2009 to Torres del Paine National Park, a complete, isolated forefin of a platypterygian ichthyosaur was discovered. The specimen represents one of the best-preserved *Platypterygius* forefins from the Early Cretaceous and shows some features that are not preserved in other *Platypterygius* species. Nevertheless, some factors such as the small number of *Platypterygius* specimens that has been found (McGowan, 1972; Fernández and Aguirre-Urreta, 2007; Arkhangelsky *et al*., 2008), their incompleteness and, in consequence, the difficulty to judge the factor of morphological variability make an accurate and correct taxonomic identification difficult.

The high amount of specimens and the good preservation of the Tyndall ichthyosaurs is thus crucial for the understanding of the diversity of paleocommunities of ichthyosaurs during the Early Cretaceous and may represent one of the most informative areas for Early Cretaceous ichthyosaurs in the world.

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Life history of *Rhamphorhynchus* inferred from bone histology

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Growth strategy of *Rhamphorhynchus* has been assessed based on macromorphological characters, and only one study concentrated on the microstructural features of the bones to reveal life history of the ge-

nus. However, due to the apparently conflicting hypotheses suggested so far, aspects of their growth strategy and other life history parameters still abound in uncertainties and need further testing. We present the first histological survey of an ontogenetic series of *Rhamphorhynchus*. Our results showed that Bennett's (1996) second size category also contains adults, thus it does not reflect real ontogenetic stage. Significant body size differences of histologically as well as macromorphologically adult specimens suggest developmental plasticity. Woven bone implies that hatchlings sustained a high initial growth rate, however only up to the attainment of 30–50% of adult wingspan or 7–20% of asymptotic body mass. This is in contrast with the 'superprecocial flier' hypothesis. The early fast growth phase was followed by a prolonged, reptilian-like slow-growth phase indicated by parallel-fibred bone deposition in the cortex. The onset of powered flight and not of reproduction is considered here as the cause of this transition, which has also been revealed in *Pterodaustro*. Rapidly growing young juveniles were either attended by their parents or they were immediately independent, precocial but not volant, hiding creatures until attaining a certain somatic maturity to get airborne. An EFS is absent in all investigated specimens, but due to the restricted sample size, neither determinate nor indeterminate growth could be confirmed in *Rhamphorhynchus*.

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An exceptionally complete specimen of the colossal Cretaceous sea turtle *Archelon ischyros*

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Remains of Cretaceous sea turtles (Chelonioidea) are widespread with exemplars known from North and South America, Europe, North Africa, eastern Asia, and the Australasian region. Although members of the modern cheloniid and dermochelyid lineages were present by at least the Coniacian (Late Cretaceous), by far the most diverse group were the protostegids — a basal radiation that first appeared during the Aptian-Albian but went extinct by the early – middle Maastrichtian. Probably the most iconic protostegid is *Archelon ischyros* from the Campanian Pierre Shale of western North America (Western Interior Seaway), which is famous for its colossal body length of over four metres and which has been popularised as the largest turtle of all time.

Surprisingly, little research has been devoted to *Archelon* since the taxon was first described in the late 19th century. Several variably complete skeletons have been collected, the most spectacular of which was unearthed in South Dakota during the mid 1970's and eventually purchased and prepared by the Natural History Museum of Vienna (Austria). Painstaking preparation over a five-year period revealed exceptional preservation and the specimen now forms the centerpiece of a permanent exhibition of Mesozoic fossils. However, despite being on public display for over thirty years the fossil has never been studied in detail. A comprehensive assessment undertaken in 2011 obtained novel data on the osteology, diet, and evolutionary implications of *Archelon*. The results suggest some remarkable parallels with modern sea turtles, including durophagous habits and possibly advanced thermal physiology as indicated by flipper morphology and the highly vascularised limb bones. Contrary to some recent phylogenies, our cladistic analyses also clearly advocate chelonioid monophyly and imply that the decline of protostegids might have been linked to faunal turnover amongst benthic invertebrate prey species and extreme specialisation towards regionally endemic habitats.

Evolution of dortokid turtles in the Late Cretaceous – Paleogene of Europe

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Dortokid turtles were Early Cretaceous – Paleogene, small-sized freshwater panpleurodires, endemic to Europe. They were important elements of Late Cretaceous (Cenomanian – Maastrichtian) continental faunas throughout Central Eastern and Western Europe, and in Romania they survived into the Paleocene (see Rabi *et al*., in press and references therein) or based

on our new data, even into the Eocene. New material from the Santonian of Hungary and the Maastrichtian of Romania and the revision of material from the Campanian of Austria indicate the presence of an "eastern" lineage that is phylogenetically and biogeographically separated from the Late Cretaceous *Dortoka* lineage of Western Europe. The most complete specimen of the "eastern" lineage comes from the Haţeg-Basin of Romania (Sinpetru Formation) and consists of an almost complete shell including articulated girdles, thus representing one of the best materials in the family. This shell together with several other isolated plates and other skeletal elements will be later described as a new taxon (the name *Muehlbachia nopcsai* formerly given by Vremir and Codrea (2009) is considered invalid here as that publication did not satisfy the criteria of the ICZN rules). With the present contribution we attempt to clarify the phylogenetic relationships of the Late Cretaceous Western European and East Central European taxa with the Paleocene form, *Ronella botanica*. We also critically test the position of the dortokids as stem pleurodires. Aspects of character evolution, survival of K/Pg extinction, biogeography and ecology are discussed as well.

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Heterochrony in cranial suture closure of recent and fossil Xenarthra

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The Xenarthra consist of several fossil and recent groups with various 'lifestyles' and a wide size-range: an excellent group to examine morphological evolution and growth patterns. The timing of cranial suture closure provides a marker of growth, phylogeny and cranial function which can also be studied in fossils. A total of about 250 recent skulls from the five living 'families' was examined to study the changes in relative timing ('sequence heterochrony') in the closure of 52 externally visible sutures as well as differences between overall closure among and within the major clades. The observed patterns are compared to the ones in fossil xenarthrans and in other mammalian groups. The mean number of closed sites per specimen is considerably higher in sloths than in anteaters and armadillos. The amount of closed sutures does not correlate with any of the skull measurements used as proxy for size in any of the three groups. The mean number of closed sutures in relation to those measurements is highly variable, in sloths even more so than in the other two groups. Such high variability has not been reported for any other mammalian group. Xenarthrans also diverge in some aspects of the otherwise universal pattern of timing of fusion of skull regions: for example, the vault is not the first region to fuse. An event-pairing analysis of the timing data identified much homoplasy and some diagnostic shifts for certain clades, such as the basioccipito-basisphenoid suture closing after the closure of the mandibular symphysis only in Folivora and the naso-frontal suture closing before the fronto-lacrimal suture only in Myrmecophagidae.

Grasping capabilities of *Plateosaurus engelhardti*

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The locomotion capabilities of the prosauropod dinosaur *Plateosaurus engelhardti* Meyer, 1837 from the late Triassic of Central Europe have seen ample debate in the literature. Because of the large forces locomotion places on the limbs, a manus adapted to locomotion shows strong adaptations of the range of motion and stability of the digits. An analysis of the grasping and hyperextending capabilities can therefore determine if the hand was involved in locomotion, or adapted to other functions.

We used high resolution 3D models based on CT scans of a well-preserved individual of *P. engelhardti* from the Trossingen (Germany) quarry to assess the motion range of the digits in a Computer Aided Engineering program. Both maximum flexion and hyperextension were simulated, and the ability to contain and control objects of different sizes was tested.

Although hyperextension is well developed, the total extent and the variation of extent between digits indicate that the manus was unsuited for locomotion. Instead, it was adapted to powerfully grasping of objects of a size range roughly between a small pine cone and a soda bottle. Larger objects required two-handed grasping, or clamping against the lower arm. The supposed partial opposability of the first digit reported in the literature was found not to exist. However, digits IV and V are angled throughout flexion to allow their use as a counterfort for improved control of small objects.

Skull morphology modification and dietary differences in the Triassic small protorosaurs *Macrocnemus* and *Langobardisaurus*

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The Protorosauria Huxley, 1881 (Prolacertiformes Camp, 1945) constitute a clade of mainly Triassic reptiles among which the genera *Macrocnemus*, *Tanystropheus* and *Langobardisaurus* from the Middle and Late Triassic of Northern Italy, Switzerland and recently also China, are best known. All genera share the same skeletal architecture, characterised by a long neck formed through elongation of the individual vertebrae rather than an increase in their number (with an extreme in *Tanystropheus*), and a great disparity in length between fore- and hind-limbs. *Tanystropheus* was aquatic or semiaquatic with the different species showing great size variability from the medium-sized *T. meridensis* (approximately 1.5 m long) to the very large *T. longobardicus*, (up to 5 m long), while both *Macrocnemus* and *Langobardisaurus* were smaller, swift terrestrial reptiles, able of bipedal gait during fast run.

One of the major differences among the similar-sized terrestrial taxa (*Macrocnemus* and *Langobardisaurus*) can be found in the dentition and skull architecture: *Macrocnemus* had simple homodont dentition with small, sharp teeth and a lightly built skull with slender jaws, a pattern that fits easily with the model of a carnivore feeding on invertebrates or small vertebrates which were swallowed whole or after very little processing. *Langobardisaurus* instead had a robust, short and high skull with a deep lower jaw, peg-like front teeth (absent in the lower jaw) followed by a few bulky three-cusped teeth and a large, flattened molariform last tooth. Its feeding habits are more difficult to interpret. An analysis of the functional and mechanical implications of the dentition, the skull and the lower jaw, along with a reconstruction of the jaw musculature by comparison with extant durophagous and herbivorous diapsids and anapsids, suggests that *Langobardisaurus* was able of complex food processing and may have been an omnivore feeding on hard and/or though food, possibly comprising plants.

A dinosaur "nursery" in a Lower Cretaceous clay quarry (Galve-Maestrazgo Geopark, Teruel, Spain)?

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In the province of Teruel (Spain) four new dinosaur genera and two clades (all sauropod) have been formally defined. Two genera come from the Villar del Arzobispo Formation (Tithonian-Berriasian) in Galve area, where also two new species of ornithopods of the Camarillas Formation have been proposed in an unpublished doctoral thesis. The diversity of new Mesozoic species described in Galve includes a dinosaur ootaxon and seven types of Mesozoic mammals, a lizard and a type of fish.

In Galve — Maestrazgo European and Global Geopark member — there is a clay quarry. Palaeontologists from Dinópolis keep control of the quarry since 2008. As a result of the weekly preventive palaeontological monitoring, and the consequent excavations, we have found a site with an unusual group of articulated and associated juvenile dinosaurs which are related to the small-sized ornithopod genus *Hypsilophodon*, in a Lower-Barremian layer of the Camarillas Formation. After a preliminary analysis, the morphologies of the deltopectoral crest of the humerus, the fourth trochanter of the femur and of the prepubis separate it from the species *Hysilophodon foxiis*. Hypsilophodontid fossils have already been cited in Galve: cf. *Hypsilophodon* sp., Hypsilophodontidae indet., *H. foxii* and "a new unnamed genus of Galve hypsilophodontid". The material recovered until now includes more than 500 skeletal (cranial as well as postcranial) remains of several individuals, which could have been grouped by a fluvial current or, as it happened with other small-

sized ornithopods, they could represent the fossilised remains of a breeding place.

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Functional morphology and palaeohabitat predictions: a case study of Plio-Pleistocene endemic bovids from Sardinia

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A variety of methods have been developed to use bovid postcranial elements in the functional-morphology approach to palaeohabitat prediction (e.g. Kappelman, 1988; Degusta and Vrba, 2005; Klein *et al*., 2010). This study represents a first attempt at testing such methods on insular fossil bovids, focusing on the Early Pleistocene Sardinian specimens assigned to the so-called "*Nesogoral* group", which includes at least three different morphotypes (Palombo, 2009). The peculiarity of these taxa, similar in body size and showing a combination of "Caprini" and "non-Caprini" features, makes the attempt to clarify their taxonomic identity and phylogenetic relationships undoubtedly challenging. Measurements of Sardinian postcranial specimens (femur, astragalus, proximal, intermediate, and terminal phalanges) were processed in comparison with those of the main extant groups of Bovidae (including the enlarged tribe "Caprini") to predict habitat preference category (Forest, Heavy Cover, Light Cover, Open), body weight and taxonomic affiliations. A principal component analysis (PCA) has been carried out to further investigate the structure of the data. Results obtained, on the one hand, stress the difficulty of inferring palaeohabitats of fossil bovids from the functional morphology of their bones (also in extant bovids, the assignment of a taxon to a particular category is at most a "best fit" designation because a number of bovid taxa range over several habitat types), and on the other hand suggest that the majority of Sardinian bovids were Forest to Light Cover dwellers, albeit they developed peculiar features compared to the living taxa.

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Oligocene to Early Miocene evolution of large terrestrial "hoofed-mammals" in Western Europe

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Western Europe was affected by important climatic and environmental changes between the Late Eocene and Middle Miocene (34–15 Ma). The best known faunal interchanges are: 1) the "Grande Coupure" at the Eocene – Oligocene boundary, and 2) the "Proboscidean Datum Event" in the Middle Miocene. The Oligocene is considered by many as a quiet period, without major faunal turnovers. However, the study of European large terrestrial mammals (such as Rhinocerotoidea, Tapiridae, Anthracotheriidae, Suoidea, or Ruminantia) highlighted many events, at least within the herbivores. The "mid-Rupelian Faunal Turnover" (RFT, Scherler in progress) occurred in MP23 (Early Oligocene). It is characterized mainly by 1) speciations, e.g. the appearance of *Elomeryx borbonicus*, *Ronzotherium romani*, and 2) extinctions, e.g. *Elomeryx crispus crispus*, *Anthracotherium monsvialense*. This event coincided with the Oi2 glaciation of Antarctica (30.3 Ma; Pekar *et al*., 2006). During the Chattian, a succession of specific extinctions (e.g. "*Anthracotherium*" *hippoideum*, *Eggysodon gaudryi*), speciations (e.g. *Anthracotherium magnum*, *Protapirus bavaricus*), and

emergences (e.g. *Doliochoerus quercyi*, *Microbunodon minimum*) occurred: six events could be recognized from MP26 to MP30/MN1 ("European Terminal Oligocene Faunal Events", ETOFE 1 to 6; Scherler in progress). These turnovers began along with the "Late Oligocene Warming" (MP26–28; 27.6–24.0 Ma; Vianey-Liaud, 1991) and coincided mostly with major glaciations of Antarctica.

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Utilizing morphometrics and histology of appendicular skeletal elements to determine what *Dimetrodon* species are present in the Briar Creek Bone Bed (Lower Permian, Archer County, Texas)

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The Lower Permian of western Archer County (Texas, USA) is one of the richest sources of *Dimetrodon* bones. Based on size, a small (*D. natalis*), an intermediate (*D. booneorum*), and a large species (*D. limbatus*) have been described from a number of localities of the same age (Romer and Price, 1940). Alternatively, it has been proposed that these traditionally recognized taxa perhaps represent an ontogenetic series of a single species (Bakker, 1982). This hypothesis was based on a regression analysis of the distal epiphysis width as a function of humerus length. The ontogenetic series hypothesis, coupled with environmental interpretations of the sites, led to the suggestion (Bakker, 1982) that adults and juveniles of *Dimetrodon* preferred different habitats. However, the ontogenetic series hypothesis is inconsistent with the late ontogenetic state of some of the small bones as suggested by their morphology (Brinkman, 1988).

Histologic analysis of newly excavated material from the Briar Creek Bone Bed (Nocona Formation, Artinskian), procured over two field seasons, has resolved some of these discretions. *D. natalis* cortical bone consists of prominent lamellar zonal bone, the medullary region is infilled with cancellous bone. Analysis of the juvenile femora revealed no visible growth cycles in the cortex, bones of intermediate size contain two growth marks, and the largest specimens show up to four growth cycles, ending in a well-developed external fundamental system. Radial canals and osteocytes are denser in the juvenile specimens, suggesting a higher growth rate. Large erosional cavities in the periosteum and secondary cancellous bone are abundant in the intermediate humeri. The long bone histology of *D. natalis* thus suggests that it is not the juvenile of a larger species, and most likely a valid taxon. The histologic data is complemented by a regression analysis of the minimal circumference of the diaphysis of femora and humeri as a function of their length. Validation of the other *Dimetrodon* species is underway but still unresolved at this time.

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Bone microstructural requirements at large size and fibrolamellar bone convergence

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Evolution of vascular organisation of sauropodomorph bone histology is correlated with body size increase. Small basal sauropodomorphs like *Saturnalia* and *Thecodontosaurus* retain mostly longitudinal vascular canals. Larger sauropodomorphs like *Plateosaurus* and *Massospondylus* have more circumferentially oriented

vascular canals, whereas sauropods have completely circumferentially oriented blood vessels in an architecture called laminar bone. The becoming of the blood vessel architecture as more laminar with increasing body size is most likely explained by a trade-off between growth rate and biomechanical requirements. De Margerie *et al.* (2004) suggested that laminar bone deposition is more energy demanding than longitudinal or radial bone, but much more stable because of stress and strain dissipation along the circumferentially oriented bone laminae. They studied the bone histology of the king penguin, and found more pathologies in radial bone, which is deposited more energy efficient. A similar trend of increasing laminarity with body size is observed in mammals. Mammals and dinosaurs have identical cortical bone tissues, called fibrolamellar bone, a composite tissue of woven and lamellar bone, suggestive of rapid growth. However, parsimony suggests these tissues evolved convergently in both lineages. Osteocyte lacunae density of several dinosaur and mammal taxa confirms this. Moreover, high lacunae densities in saurischian dinosaurs compared with low lacunae densities in ectothermic poikilotherms suggest saurischians had a sustained high metabolic activity.

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The new locality of freshwater fishes from the Eocene of Northern Primorye (Russian Far East)

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In the western part of the Nizhnebikinskaya Depression (Northern Primorye), the skeletal remains of freshwater fishes have been discovered in the silty sand basal layer of the Eocene – Early Oligocene sediments. The fossil-bearing unit crops out on the left bank of the Bikin River. Close to fish locality, some plant remains, presumably of Early Eocene age, have been collected. The fish assemblage includes an amiid and a cyprinid.

The amiid specimen, which displays a ventrally exposed block including the skull and anterior part of the body, belongs to *Cyclurus* sp. Its proximity to *Cyclurus orientalis* (Chang Meeman, Wang Ning, Wu Fei-Xiang, 2010) from the Early-Middle Eocene of China seems plausible. It is the first amiid find from the Paleogene of Primorye. During the Eocene the genus *Cyclurus* was widely distributed around the Holarctic. In particular, its Asiatic record includes numerous finds from Eastern Kazakhstan, Southern and Inner Mongolia, supplemented more recently by the material from Southern China.

The teleost fossils from the Bikin locality include a number of complete (or nearly so) skeletons belonging to a new cyprinid genus. In all, the above reported data extend previous knowledge of the Paleogene freshwater ichthyofauna of Primorye. So far, the latter was known to embrace the catostomids (Eocene – Oligocene), salmonids and cyprinids (both from Oligocene).

The first discoglossid frog from the Late Cretaceous (Santonian) of Hungary (Iharkút, Bakony Mountains)

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The Late Cretaceous (Santonian) assemblage of Iharkút (Hungary) originates from fluvial and floodplain terrestrial deposits which yielded a large amount of vertebrate fossils including relatively well-preserved bones of amphibians. For the extraction of microvertebrate remains the so-called paraffine wax method was improved. The first discovered frog from this locality was *Hungarobatrachus szukacsi* Szentesi et Venczel, probably a member of the primarily Gondwanan distributed Neobatrachia. The new records putatively belong to the family Discoglossidae, based on the distinctive ilium, and are member of Laurasian distributed Discoglossinae representing Archeobatrachia. The referred material includes a maxilla, an angulosplenial and a scapula, reminiscent of discoglossine frogs. The Iharkutian discoglossid differs from other discoglossine frogs by its distinctive ilium provided with a thickened and dorsolaterally depressed protuberance of the ilium, in combination with a relatively high iliac crest and a ventrally less widened ilioischiadic junction.

The palaeogeographic circumstances of the Iharkút re-

gion, as part of the Adriatic microplate, show that the autochthonus lissamphibian fauna, primarily consisting of albanerpetontids and discoglossids, was enriched during the Santonian by new Gondwanan components representing Neobatrachia. The majority of vertebrate taxa known from the locality are of Euroamerican affinities. However, some other unearthed remains may belong to Gondwana-related taxa (e.g. bothremydid turtles, sebesuchian crocodilians, abelisaurids), whereas others may represent endemic forms.

On the need of systematic protection, study, conservation and management, of the Greek palaeontological treasures: Proposal for the establishment of the National Natural History Museum at Pikermi, Attica

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Greece hosts hundreds of fossil-rich localities. Many of them will wait for several years for a palaeontological excavation, if they manage to be salvaged. For the last two decades there has been a slow but steady progress on the conservation and management of some of them via the design and operation of several local museums. The first related Greek Law was voted in 1932 with respect to the protection of the fossil vertebrates. Fifty years went by for the first actual government actions (by the Ministry of Cultural Affairs – YPPO), dating 1984, that regarded the protection of the wider excavation area of Pikermi and a year later for the protection of the fossilized forest of Lesvos. From available records the oldest relevant text to support the protection of a palaeontological location dates back to 1901 for Pikermi, but it seems that 110 years were not adequate for the implementation of crucial development steps. The existing small, local museums that were created with tremendous efforts face the daily danger of closure since the current Greek legislation "Kallikratis" is not very suitable — even prohibiting – for any positive measures.

What should be done then? We must progress systematically — beyond the necessary scientific steps — towards the wider knowledge dispersion to the ministries and local authorities. It is not enough to limit our actions in publications in international scientific journals — not accessible to the 99.999% of the public — and count the amount of citations of our work in the US, China or the Netherlands. This is certainly necessary for the scientific community, but it is not enough. Our questioning should be how many Europeans had the chance to see an exhibition of unique findings. The state should create and operate a significant amount of palaeontological sites or museums, spread all over Greece and an adequate number of working positions. Palaeontology teaching candidates in universities should have to prove that they have worked for this, as well. This could have as a result the creation of a critical mass of vertebrate palaeontologists, capable of working on this natural treasure, before it is too late. The sensitization of the public will have to start at the primary and secondary educational steps and be completed with the founding and operation of several local museums or exhibitions as appendices of a National Natural History Museum, located at Pikermi, next to the world-known excavation sites implementing outdoor coverts for the protection of fossils *in situ*. It is actually sad that the kids in our schools do not learn anything about palaeontology nor visit palaeontological sites or exhibitions of natural heritage. Many of us have made significant steps with several ongoing projects supported by NKUA SARG: Tilos Island, Achillio (Magnesia), Kerassia (Euboea), Poros, Rethymnon (Crete), Pikermi (Attica), Lesbos Island, Cyprus etc., but unfortunately this is not enough. These projects create several research options and training possibilities for graduate and postgraduate students of geology, biology, museology and environmental archaeology and on the other hand aim at the sensitization of the general public, but definitely cannot be considered a final solution. Areas such as Megalopolis, the wider Rethymno region, Halmyropotamos and Kymi are included among our future goals.

Let's have a look at Polledrara di Cecanibbio, the coalmines of Sztolnia Krolowa Luiza in Poland, the coalmines of Carbonia in Sardinia, the Mammoth Site in South Dakota and compare them to equivalent geological Greek sites. This will allow us to see that in an era of financial crisis, in a country with more than 15,000,000 visitors per year, we have a precious hidden unexplored treasure, which scientific and economic value could have a crucial role in the development of our country. Shouldn't we then just simply move all together and aim at proper knowledge distribution towards the general public and the officers at the decision centers?

New discoveries of vertebrates from the Upper Campanian locality of Jas-Neuf Sud (Var, Southeastern France)

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The locality of Jas-Neuf Sud (Var, Var and Bouches-du-Rhône, Southeastern France) is one of the most remarkable fossil localities in the Provence for its diversity of preserved taxa (dinosaurs, pterosaurs, crocodilians, chelonians, fishes), the quantity of fossils (more than 450 specimens were collected) and the quality of the preservation. The site was discovered in 2006 during the course of works undertaken to open new lanes along the A8 highway east of the city of Aix-en-Provence. Excavations in this site were conducted by the Museum of Natural History of Aix-en-Provence, funded by highway company ESCOTA in 2006 and 2007 and have been resumed since September 2010.

The new campaign has provided a large amount of new data on poorly known local taxa, especially dinosaurs, crocodilians and chelonians. The most interesting dinosaur remains include a series of titanosaur vertebrae in anatomical connection (from the last cervical vertebrae to the middle dorsals) and several teeth of titanosaurs and abelisaurs. The site is also known for its richness in crocodilian remains (attributed to *Ischyrochampsa* and *Musturzabalsuchus*). The discovery of several partial and complete dentaries indicates the presence of a third and new taxon. Finally, the locality provides new information on a probable solemydid turtle after the discovery of an ornamented partial carapace found associated with a humerus. Another interesting feature of this locality is the sedimentological context. The vertebrate-bearing sandstone beds are the result of crisscrossed meandering channel deposits. A study of the content of each unit deposit (channel) allows a better understanding of the evolution of vertebrate populations over relatively short geological time spans, which has never been observed elsewhere in the Provence.

The Middle Pleistocene deer of the Katharo basin (Crete, Greece) and its importance for a better understanding of the evolutionary history of the insular fauna of Crete

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Within the Pleistocene sediments of Katharo basin sites with fossil hippos have been discovered (Fig. 1). Absolute dates (AAR and ESR) for hippopotamus molar fragments from Katharo range between 850,000 and 375,000 years ago (Reese *et al*., 1996), which means that the deposit is of Middle Pleistocene age. Although the majority of the fossils from Katharo belong to dwarf hippopotamuses (*Hippopotamus creutzburgi*), a few fossils of a dwarf elephant (*Elephas antiquus creutzburgi*) and of an unnamed dwarf *Megaloceros* have been reported as well (Dermitzakis *et al*., 2007). The presence of three large herbivores on the island might explain why the Cretan hippopotamus did not become as small as the Cypriot hippo (*Phanourios minor*) did. Part of the ecological niches that could be potentially taken by hippopotamuses were occupied by deer and elephants. Since the ecological release from competitors was smaller on Crete than on Cyprus the Cretan hippopotamus did not become as small as on Cyprus.

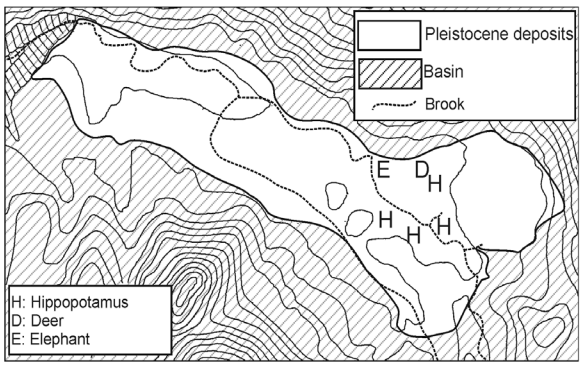

Figure 1. Fossil sites with Pleistocene mammals on Katharo basin

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New data on the late Miocene – early Pliocene micromammalian locality of Kessani (Thrace, Greece)

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A micromammalian fauna recovered about fifteen years ago from an argillaceous bed on the southwestern coast of Lake Vistonis (Xanthi – Komotini Basin, Thrace, NE Greece) and partially determined in Syrides *et al.* (1997) has been thoroughly re-examined. The small but rather diverse (in terms of rodents) collection of isolated teeth (NISP = 111) has revealed the presence of *Asoriculus gibberodon*, *Deinsdorfia kerkhoffi*, Soricidae indet., *Prolagus michauxi*, Leporidae indet., *Pliopetaurista dehneli*, *Myomimus maritsensis*, cf. *Arvicanthis* sp., *Occitanomys adroveri*, *Apodemus gorafensis*, *Apodemus dominans*, *Rhagapodemus primaevus*, *Micromys steffensi*, *Mesocricetus primitivus*, *Pliospalax* sp. and *Pseudomeriones* cf. *rhodius*. The composition of the fauna and its comparisons with the Turolian and Ruscinian micromammalian faunas from Greece suggest a late Turolian – early Ruscinian (MN13 – MN14) age.

The taxa favourable of dry conditions represent 51.2% in the total MNI (21 of 41 individuals), those favourable of wet conditions only 24.4% (10 of 41 individuals). In addition, the presence of *Arvicanthis*, a rat of African origin, indicates a rather arid palaeoenvironment. In this dry land, the presence of a small water spot is indicated by the presence of three (maybe four) soricid species and *Micromys*, whereas the presence of *Pliopetaurista dehneli* verifies the presence of trees.

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Micro-mammalian inhabitants of the Lesvos Petrified Forest (Greece)

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The Lesvos Petrified Forest (Lesvos, Greece) is a world-famous natural monument, comprising of hundreds of tree trunks, fossilised *in situ* after their covering by pyroclastic material and mud-flows, following volcanic eruptions. Fossilised trunks, roots, branches and cones, as well as leaf prints, are found across the western part of the island and on the sea bottom, representing large subtropical forests that covered the Aegeis landmass 21–17 million years ago. Even though the palaeoflora of the area has been known and studied for centuries, the animals inhabiting the forest have only recently started "appearing". In 1999, the lower cheek teeth of the proboscidean *Prodeinotherium bavaricum* were found in lake sediments within the Petrified Forest (Koufos *et al*., 2003), representing one of the first proboscideans in Europe.

Since 2007, efforts have been made to find Neogene lake sediments that can be processed for micromammals. Despite the strong silicification of the sediments in the area, a layer of organic-rich clays was located in the Gavathas – Lapsarna basin, which revealed fossil lake gastropods, isolated fresh water fish otoliths and pharyngeal teeth, small reptile teeth, small lizard dentaries, and micromammalian teeth and bones. A species of *Eumyarion*, a species of *Democricetodon* and the glirid *Glirulus diremptus* have been until now identified. All three have been found in Greece in the localities Aliveri and Karydia, both correlated with the European mammal zone MN4 (Koufos, 2006). The new locality in Lesvos is also correlated with MN4 and its further study will give information on the geographical distribution and migrations of Asian micromammals into Europe, as well as on an accurate reconstruction of the subtropical forests of the area.

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Vertebrate fossils in Geoparks: a tool for the promotion of responsible tourism and the economic development of rural areas

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Palaeontology is a popular science and the remains of extinct organisms, mainly of vertebrates, impress people and especially children. Even in ancient times, the remains of unknown creatures attracted much attention and attempts by ancient people to explain the occurrence of organic remains in rocks and such stories can be found in the mythological stories of the ancient Greeks and other civilizations.

But how can researchers explain the importance of vertebrate remains, including those of extinct animals, to the public? How can the scientific community interpret the occurrence of fossils and communicate their use in reconstructing the history of our planet? And how can scientific knowledge that has been accumulated for centuries be used in favour of our modern society? Such issues are examined and resolved in established Geoparks, rural areas of great scientific, environmental, educational importance, engaged mainly in the interpretation of scientific knowledge to locals and visitors, through the use of various educational tools.

Established in 2000, the European Geoparks Network (EGN) aims to protect geodiversity, to promote geological heritage to the general public, and to support sustainable economic development of geopark territories, mainly through the development of geological tourism. The network consists of 43 territories (October 2010), a vast majority of which include vertebrate fossil sites in their inventories. The Lesvos Petrified Forest and Psiloritis Geoparks in Greece, the Maestrazgo Geopark in Spain, the Bergstraße-Odenwald and TerraVita Geoparks in Germany, the Réserve Géologique de Haute Provence and Luberon Geoparks in France, the Haţeg Country Dinosaurs Geopark in Romania are only some examples of vertebrate fossil promotion and use for the sustainable development of the regions from which they originate.

Communicating past mammalian biodiversity: "From the deinothere of the Lesvos Petrified Forest to the Man of the Petralona Cave", a temporary exhibition in the Natural History Museum of the Lesvos Petrified Forest

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Aiming to demonstrate past biodiversity in the Aegean, in the frames of the celebration of "2010 – International Year of Biodiversity", the Natural History Museum of the Lesvos Petrified Forest designed the temporary exhibition "Fossils of the Aegean – Mammal Biodiversity: from the Deinothere of the Lesvos Petrified Forest to the Man of the Petralona Cave", complemented by educational programs for children of all ages. Fossils of forty mammals that lived in the Aegean area during the past 23 million years are presented, belonging to the Museum of Geology and Palaeontology (Aristotle University of Thessaloniki), the Natural History Museum of Crete, the Natural History Museum of Milia (NW Greece), the Rethymno Municipality (Crete) and the Natural History Museum of the Lesvos Petrified Forest.

Ecosystems that covered successively the area providing niche to the animals on display are reconstructed. Posters interpret information about each fossil, illustrate the animal and describe its habits. Diverse tooth and bone morphologies of the four main mammalian orders (carnivores, perissodactyls, artiodactyls, proboscideans) are interpreted, explaining links between animals' anatomy and lifestyle, as well as adaptation mechanisms to a constantly changing environment.

Feedback suggests that the design of the exhibition and the educational programs is engaging and effective. This success is translated in large numbers of visitors since its opening on the 17th July 2010: 17,000 people and 500 pupils and teachers from twelve schools have visited the exhibition. Even though the exhibition was originally due to last for eight months, till March 2011, its success has led to its extension for six more months, till September 2011.

Life style and life history of recent and fossil Eurasian Cenozoic giant salamanders (Cryptobranchidae; Amphibia)

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Cryptobranchids represent a clade of the largest living, crown-group salamanders that can reach up to two metres in total length. The three recent giant salamander species are distributed in North America (*Cryptobranchus*) and in East Asia (*Andrias*). In the Eurasian fossil record they are known since the Paleogene with several genera (*Aviturus*, *Zaissanurus*, *Andrias*, and a new genus from the Miocene of Ukraine). The recent cryptobranchids have a strictly aquatic lifestyle and are confined to clear, well-oxygenated, cold mountain streams and rivers. All three recent species have incomplete metamorphosis and paedomorphic characteristics. *C. alleganiensis* is the most "neotenic" among living species with the presence of internal gill and gill slits, whereas these are absent in Andrias.

In our analysis, we studied all fossil Cenozoic cryptobranchids from Eurasia. Their mode of lifestyle, life history, as well as the environment of larval development and feeding types was inferred based on osteological characters (e.g. pattern and position of vomerine dentition). Our results suggest that *Aviturus* is a metamorphic, terrestrial/semiaquatic? salamander with larval development in ponds and has a terrestrial feeding type (protraction). *Zaissanurus* and *Andrias* on the other hand are non-metamorphic, aquatic salamanders with larval development in streams/rivers and feed by suction and prehension (aquatic feeding type). The terrestrial lifestyle of *Aviturus* is further corroborated by strongly ossified and compact skull bone tissue, relatively long extremities (hind limbs) and a well-developed olfactory region of the brain case. The absence of ossified ceratohyals in hyobranchial skeleton of *Andrias scheuchzeri* indicates the lack of gill slits and internal gills, similar to recent *Andrias* species and contrary to recent *Cryptobranchus*.

On the evolution and systematics of the tribe Megacerini (Artiodactyla, Cervidae)

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Megacerine deer (tribe Megacerini, subfamily Cervinae) existed in Eurasia from the Late Miocene up to the Holocene. The origin and relationships of the group are widely debated particularly because of the contradictive results of molecular biology. The systematics and phylogeny of megacerines were based mainly on the antler structure. According to various authors, the group comprised from one to twelve genera and was divided at least into two main Pleistocene lineages (*Megaloceros giganteus* and *Praemegaceros verticornis*).

The revision of the systematics and phylogeny based on the study of the skull, dentition and limb-bones confirms the high diversity of the group. Ten genera (*Megaloceros*, *Megaceroides*, *Praemegaceros*, *Praedama*, *Sinomegaceros*, *Arvernoceros*, *Neomegaloceros*, *Candiacervus*, *Orchonoceros*, and *Praesinomegaceros*) are included in its composition, and three main lineages (*Praesinomegaceros – Sinomegaceros*, *Orchonoceros – Praemegaceros*, and *Arvernoceros – Megaloceros*) are traced.

The data on megacerines from Central Eurasia and the finding of the most ancient representative of *Praesinomegaceros* in the Late Miocene of Eastern Siberia (Taralyk-Cher locality in Tuva) gave valuable information for the reconstruction of megacerine evolution. The group branched off the Cervidae tree not later than 7 Ma. The tribe Megacerini originated from the pliocervine deer *Cervavitus* and evolved in parallel with the tribe Cervini (*Cervus*, *Dama*, *Eucladoceros*, etc.). The evolution of the group followed the stream of environmental transformations of Northern Eurasia. The most essential bio- and dispersal events coincided approximately with the major global climatic and regional landscape-climatic changes.

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New finds of giant tortoises from Thessaloniki area: the most complete *Cheirogaster* Bergounioux, 1935 skeleton in Greece

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Giant tortoises from the area of Thessaloniki are known since the beginning of the last century, when Arambourg and Piveteau (1929) presented material from various sites (Axios valley and Megalo Emvolon). Among the fossils were a partial skull and various limb bones of a giant tortoise, attributed later to cf. *Cheirogaster* sp. (Lapparent de Broin, 2002). More material from Megalo Emvolon has been described by Bachmayer *et al.* (1979).

All these specimens need to be revised under the light of the discovery of new material in the coastal area of Western Chalkidiki (Macedonia, Greece). The new material comes mainly from two individuals from Epanomi, the female EPN I and the male EPN II. Especially EPN I, which was discovered in 1998, is the most complete specimen of a giant tortoise found in Greece, preserving the complete plastron, skull, the largest part of the post-cranial skeleton, carpals, tarsals and osteoderms. The new material, which preserves the characters of the genus *Cheirogaster* Bergounioux, 1935, is currently under study, but the preliminary description (Vlachos, 2011) reveals that it is different from already studied material from Greece, providing evidence that it belongs to a new species of a Pliocene continental giant tortoise, measuring up to 120 cm in length.

Additional study of the new specimens and revision of already published material can provide a wealth of information about the systematic position of the genus *Cheirogaster*, the morphology of giant tortoises, sexual dimorphism and their contribution to the interpretation of the palaeoenvironment.

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Developing geotouristic routes in Northern Greece: a case study on the evolution of proboscideans based on the fossil record

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Geological tourism, or "geotourism", mainly focuses on geological formations that involve both 'form' and 'process'. Palaeontology offers great opportunities for high quality geotouristic routes. Up to now, very few examples of geotourism based on palaeontology are known in Greece, one of them being the Lesvos Petrified Forest Geopark.

This case study from Northern Greece aims to show how via guided tours the evolution of proboscideans can attract the public interest as well as promote palaeontology and raise awareness on environmental processes. Proboscideans are an excellent example for understanding evolutionary processes based on the fossil record, since their large fossils are usually eager to become fossilized and discovered, therefore they are quite common in fossil collections. Moreover their evolution is more or less well known especially under the scope of environmental changes. The geotouristic route follows a museum network in Macedonia and could start from the Museum of the Geology School of the Aristotle University of Thessaloniki, where the visitor can be informed about the fossilization processes and learn about the Pleistocene proboscideans from Macedonia and the Miocene proboscideans from Axios and Samos. Next, the newly developed Siatista Palaeontological Exhibition (W. Macedonia) offers a detailed preview of the evolution of proboscideans via several scientific reconstructions, focusing on the interaction between artists and scientists. The recovered remains of the Kaloneri and Ambelia (W. Macedonia) straight-tusked elephants contribute to the reconstruction of this animal. Pliocene proboscideans are interpreted in the Milia Palaeontological Exhibition,

with the world-famous fossil record of the mastodon *Mammut borsoni*. Returning to the starting point, visits to the Ptolemaida Museum and the Perdikkas elephant excavation site will offer a great opportunity to discover the Pleistocene elephants and to point out their morphological differences with mastodons. Finally the visitor will learn about elephants of the last Ice Age, the woolly mammoth and the importance of climatic changes in the Mammoth Museum, Oreokastro, Thessaloniki.

This geotouristic route enhances touristic development in rural areas, motivates local people to contribute to the scientific research and provides high-level interactive education to young people and students. Finally, this case study on geotourism can inspire similar efforts in the area of Northern Greece, since there are many sites of special interest with high potential for geotoutistic activities (unique landforms and geological formations, hiking trails, karst features, gorges etc).

Taking scientific studies to the public: the Dino Expo skeletons

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The Dino Expo is, as its name implies, an exhibition on dinosaurs. It was originally installed from March 2010 till September 2010 at Castelo Branco (Portugal) and currently is housed at the Leeuwarden Natuur Museum (the Netherlands). Main pieces of the exhibition are skeletons, eggs and footprints of Mesozoic reptiles. The specimens are coming from the United States, Mongolia, Brazil, Argentina, China, Russia, Germany and Portugal. The main theme of the exhibition is dinosaurs, but skeletons and life reconstructions of flying reptiles and birds are presented as well.

The exhibition, which is addressed to the general public, has a two-fold aim: (1) to present the Mesozoic diversity and (2) to explain some of the scientific methods involved in their discovery and study. The central piece of the Dino Expo is the "story" of a 17-meter long *Diplodocus*. A real excavation has been re-created including the original bones, the tools that were used, an educational video and finally the skeleton of *Diplodocus* itself. The exhibition also includes a dig site, where children can excavate a life-size *Tarbosaurus bataar* from the Gobi Desert.

From small pieces to big displays: the reconstruction of giant extinct species

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Although most fossil species remain dry scientific descriptions in papers only known to a small elite group of experts, certain species such as the large vertebrates attract more attention and therefore skeletal mounts (Fig. 1) and "life" reconstructions are made (Lyras, 2009). Building life-size replicas of extinct giant animals is both scientifically and technically challenging. In this contribution I explain these challenges by presenting the building process of four exciting vertebrates: a mammoth (now on exhibit at the Expo Centre Bicentanario Leon, Guadelajara, Mexico), a deinothere (on exhibit at the Natural History Museum of Crete, Greece) and two sauropod dinosaurs (on exhibit at Naturalis, Leiden, the Netherlands, and Gunma, Prefectoral Museum, Japan).

Fig. 1. Adding the tail to a *Carnotaurus sastre* cast.

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An ancient settlement at Kao Ego, Phetchaburi Province, Thailand

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A recent finding at Kao Ego in Phetchaburi Province, Central Thailand, has served as a hypothesis for the migration of prehistoric humans and their settlement along the Malay Peninsula in the uppermost part of the Holocene period. Several cave deposits adjacent to the site such as Tham Lek, Tham Men, Tham Nok Pirab, Tham Rak Sai, and Tham Thamamongkol have yielded archaeological evidences as well as faunal remains suggesting human occupation. In addition, a number of artifacts were recovered such as flake tools, pottery sherds, and bone beads. The tools, based on the flakes from Tham Rak Sai, can be compared to the "type C" method which is common from the Pleistocene to the mid-Holocene in Southeastern Asia sites. Moreover, the sites also yielded a diverse fauna with *Heosemys grandis* and *Indotestudo elongata*, Tupaidae, Soricidae, Insectivora, Chiroptera, *Bandicota* sp., *Rhizomys* sp., Hystricidae, *Macaca* sp., Colobinae, *Cervus* sp., *Bubalus* sp., *Naemohedus goral*?, and *Naemohedus* sp. etc. Based on the preliminary taphonomic analysis, cut marks and carnivore tooth marks have been observed on several bones, which are informative for the predator – prey interaction and subsistence behaviour. In sum, these evidences allow us to observe the prehistoric settlement along the Malay Peninsula in the uppermost part of the Holocene and also to understand the mode of economic and resource exploitation of these Prehistoric people.

Diversity of Ruminants in the Quaternary sites of Thailand

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Ruminants, as the first consumers of the food chain, represent an important group within terrestrial ecosystems. The record of Quaternary ruminants in Thailand has yielded several fossils and subfossils in palaeontological and archaeological sites respectively. The aim of our study of this group is to contribute to the knowledge of their diversity during the Quaternary. This is interesting as the Quaternary was a period that was characterized by fluctuating climatic / environmental conditions related to the recent epoch. Moreover, they help to understand human cultural development as they are important food and economic goods. In this study, we compiled and analyzed data obtained from museum specimens from both palaeontological and archaeological sites from four localities in three provinces of Thailand: Kok Soung, Nakon Ratchasima Province (Middle Pleistocene), the Thamlod rockshelter, Mae Hong Son Province (Late Pleistocene to Recent), and Tham Rak Sai and Tham Thamamongkol, Phetchaburi province (Early to Middle Holocene). These localities have yielded several ruminant taxa such as *Cervus unicolor* (sambar deer), *Cervus* spp. (deer), *Bubalus bubalis* (water buffalo), *Bos* spp. (cattle), *Muntiacus* spp. (muntjac), and *Naemorhedus* / Caprinae spp. (gorals or serows). The age of fore-mentioned localities ranges from the Middle Pleistocene till present. Only *Axis axis* (spotted deer) from Kok Soung is restricted to the Middle Pleistocene, and became extinct from Thailand in the Late Pleistocene. Based on data from the four localities in Thailand, ruminants showed high diversity which is probably evidence of their palaeogeographic distribution and community change during the Quaternary.

Testing a developmental model in the fossil record: molar proportions in South American ungulates and in other mammals

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It is rare if not impossible to conduct developmental studies of fossil taxa, but the extinct phenotypes provide an indirect but rich source of data for analyses. This is the case of molar teeth of adult mammals. An 'inhibitory cascade' developmental model, based upon murine rodents, has recently been proposed by Kavanagh *et al.* (2007) to explain lower molar proportions. We produce a clade-wide macroevolutionary test of the model using the dental evolutionary trends in a unique radiation of extinct mammals endemic to South America. The studied 'Meridiungulata' cannot

be characterized by a model whereby m3 size is predicted by m1 size, as would be predicted. Instead, the m2 acts as intermediary between m1 and m3. Most of the clades examined follow the phenotype of m1 < m2 = m3. The exception are two groups that differ significantly from the model: Interatheriidae are characterized by m1 > m2 < m3, whilst Astrapotheria are best represented by m1 < m2 < m3. Body mass estimates were found to be significantly correlated with both m3/m1 and m2/m1 ratios. Larger body size is coupled with a weaker inhibition between the lower molars. This is one of many examples of the great potential that the examination of extinct phenotypes can provide in a developmental context, as shown by a review of recent published works such as those concerning vertebral numbers in amniotes and squamation in fishes.

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The Palaeoenvironment of the spinosaurid-bearing strata in the Khok Kruat Formation from Northeastern Thailand

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The discovery of spinosaurid dinosaurs from northeastern Thailand began in the Sao Khua Formation (Early Cretaceous) at Phu Pratu Teema (Phu Wiang National Park), where peculiar isolated teeth were found. They were referred to a new unusual theropod, *Siamosaurus suteethorni* Buffetaut et Ingavat, 1986, showing similarities with spinosaurids. In addition, the Khok Kruat Formation yielded isolated teeth which resemble those of *Siamosaurus*, although differences in size and morphology strongly suggest that several taxa are present. A recently discovered partial skeleton from the Khok Kruat Formation consists of several cervical and dorsal vertebrae, including a tall neural spine, and pelvic and limb elements, which are similar to those of the spinosaurid *Baryonyx walkeri* from the Early Cretaceous of England, but also show some characters reminiscent of *Spinosaurus aegyptiacus* from the Cenomanian of Egypt. In Thailand, spinosdaurids are represented in the Sao Khua and Khok Kruat Formations, by several taxa. *Siamosaurus suteethorni* is an enigmatic dinosaur known only by peculiar isolated teeth which have tall and slightly compressed crowns with ribbed enamel and very faint or non-existent serrations (Buffetaut and Ingavat, 1986). Based on the isolated teeth, this dinosaur was referred to the Spinosauridae, but more material is needed to confirm possible affinities within this group (Buffetaut *et al*., 2005). Spinosaurid remains in the Khok Kruat Formation have received little attention, although isolated teeth are relatively common at many localities. At Khok Pa Suam, Ubon Ratchathani Province, for example, a number of *Siamosaurus*-like teeth have been found. A partial skeleton of a large theropod has recently been discovered at an outcrop of the Khok Kruat Formation near the city of Khon Kaen. This material simply confirms the occurrence of a spinosaurid in the Khok Kruat Formation. The authors have synthesized the lithostratigraphic sections of localities which have yielded remains of spinosaurs in Thailand. Fossil localities will be compared with other Khok Kruat Formation outcrops in the Khok Pa Suam and Lam Pao Dam localities in order to reconstruct the palaeoenvironment of spinosaurids in the Aptian – Albian Khok Kruat Formation of Northeastern Thailand.

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