

# MVWG



# WARSAW 2024

## Abstracts Book

5th Meeting of the ICAZ Microvertebrate Working Group

Warsaw (Poland), September 9<sup>th</sup>-13<sup>th</sup> 2024



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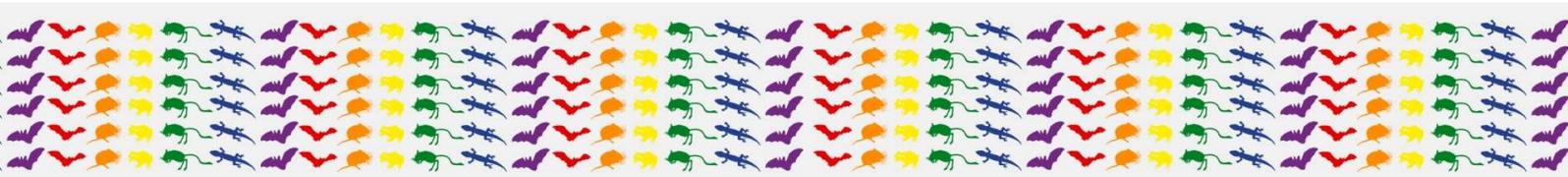
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# **Abstracts Book**

5<sup>th</sup> Meeting of the ICAZ Microvertebrate Working Group  
Warsaw (Poland), September 9<sup>th</sup>-13<sup>th</sup> 2024

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The Microvertebrate Working Group (MVWG) was developed in 2016 as a forum for the exchange of data and information related to the study of insectivore, rodent, bat, reptile and amphibian remains from archaeological deposits. These studies are published in various mediums including international journals, regional bulletins, museum archival reports, monographs and technical papers, which often cross time periods and geographic regions.

The overarching goal of the MVWG is to provide a platform for the exchange of this scientific literature and to increase communication between academics, professionals, and, in particular, graduate students with research interests related to microvertebrates. Group interests include, but are not limited to, taxonomic identification and evolution, biostratigraphy, palaeoenvironment reconstruction, commensalism, taphonomy, and studies of related methodology, scientific techniques and theory. In addition to regular working group meetings, where research will be presented via thematic workshops, the MVWG will also provide information about the most recent published literature from this field via a biannual electronic newsletter.

For more information: <https://mvwgicaz.wixsite.com/mvwg>

Website of the 5<sup>th</sup> ICAZ MVWG Meeting: <https://mvwg2024.eu>

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**2024**

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## Detailed program

### Monday, 9<sup>th</sup> September 2024 and Tuesday, 10<sup>th</sup> September 2024

#### Meeting Field Trip at Białowieża Forest

*Monday 9th September 2024*

13:00

Departure from Warsaw by bus

~18:00

Arrival in Białowieża and accommodation at Ostoja Pasibrzuch

Evening

Bonfire dinner

*Tuesday 10th September 2024*

Morning

Visit to the forest with a guide

Afternoon

Visit to the Show Reserve of Bisons

Late afternoon

departure to Warsaw by bus, the arrival is scheduled at the evening

### Wednesday, 11<sup>th</sup> September 2024

8:30-9:30

Meeting registration at the Faculty of Archaeology

9:30-9:50

Welcome by our hosts and the vice dean of the Faculty of Archaeology, University of Warsaw, Prof. Arkadiusz Sołtysiak

9:50-10:30

Keynote lecture held by Dr. Juan Manuel López-García, *Half a century of research on small mammals from the Late Pleistocene in the Iberian Peninsula*

10:30-11:00

Coffee Break

#### Oral presentations, Session 1, moderated by **Mateusz Baca**

11:00-11:20

Iván Rey-Rodríguez, *Understanding taphonomic processes in rodent remains through Neotaphonomy-CT and experimental in vitro digestion*

11:20-11:40

Melanie Lex, *New insights on the use of enzymes for the optimal recovery of tortoise remains for the IPHES-CERCA (Tarragona, Spain) reference collection*



## Thursday, 12<sup>th</sup> September 2024

### Oral presentations, Session 4, moderated by **Iván Rey-Rodríguez**

9:30-9:50

Adriana Linares, *Microvertebrate biodiversity in maar lakes: Camp dels Ninots (Spain) versus Messel Pit (Germany)*

9:50-10:10

Julia Galán, *Bringing the Quaternary fossil record of order Chiroptera up to date in the Iberian Peninsula and the Balearic Islands*

10:10-10:30

Juan Manuel López-García, *Small vertebrates from the Early Pleistocene human bearing level TE7 (Sima del Elefante, Sierra de Atapuerca, Spain)*

10:30-10:50

Mateusz Baca, *The evolutionary history of the field vole species complex revealed by modern and ancient genomes*

10:50-11:20

Coffee Break

### Oral presentations, Session 5, moderated by **Elisa Luzi**

11:20-11:40

Hugues-Alexandre Blain, *New palaeoecological investigations based on herpetofauna at the Hoxnian East Farm Barnham site (UK)*

11:40-12:00

Christian Sánchez-Bandera, *Amphibians and squamate reptiles from the Early Pleistocene site of Pirro Nord 13 (Apricena, Italy): preliminary palaeoecological reconstructions*

12:00-12:20

J. Alberto Cruz, *What the amphibians and reptiles of Rancho La Brea tell us about the paleoenvironment*

12:20-12:40

Mario Mata-González, *Snakes from the Late Natufian burial site of Hilazon Tachtit Cave (northern Israel): First results and archaeological implications*

12:20-14:00

Lunch Break

### Poster Session

14:00-15:30

Maria Pilar Alfaro Ibáñez, *Insights on the evolution of the tribe Pliomyini (Arvicolinae, Rodentia): Ancient DNA from the extinct Pliomys lenki*

Adrián Álvarez Vena, *Forest-affinity micromammal assemblages from MIS 3 of the Cantabrian Region: Insights from the La Torca del León and La Rexidora Caves (Asturias, N. Spain)*

Batistin Marsouin, *Geographical distribution and genetic structure of a cryptic species complex in voles (Arvicolinae, Rodentia)*



# Oral Communications



exchange with other populations. The pattern of genetic variation in the field vole species complex demonstrates unequivocally the impact of stadial-interstadial cycles in generating recurrent episodes of allopatry and connectivity of populations, a situation which could only be revealed by our dense genomic sampling over time.

# Vole mesowear: an intra species or interspecies paleoecological proxies?

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## Abstract

Tribology, or the study of wear, includes methods such as dental ecometric (typology, topography, and topometry). microwear and mesowear. Each of these methods reflects a different time scale captured in the tooth shape, form, and wear. Some of the methods are understood to reflect evolutionary time scale (e.g., hypsodonty) are often used for interspecies comparison and averaged across communities while intra species microwear variability which reflects the diet averaged over the last 6 days or so of the life an individual has been used to reflect seasonality. Small mammal ecometrics have pointed to the utility of Rodentia dental ecometrics as predictors of climatic variables in a range of scales.

The underlying theory behind the use of ecometrics as paleoecological proxies is the environment → food → tooth wear paradigm. Nonetheless, it is unclear what the role of demographic and morphology (age, sex and size) is in the formation of dental ecometrics. Is the size of the individual also a factor in the formation of dental ecometrics and if so, how? Is this reflected in sexual dimorphic species. Furthermore, what is the underlying distribution of ecometric variables which may have a profound effect on statistical analysis.

Here we present two complementary analyses and apply those results to an archaeological sample. The first is laboratory experiment which compared the mesowear of M<sub>1</sub> of two vole species (*Microtus pennsylvanicus* and *Microtus ochrogaster*) raised consuming identical rat chow (for a different study). Each specimen had known demographic data (age, sex) as well as skull measurements. The second included comparison of the mesowear distributions obtained in the laboratory experiments above to those obtained on *Microtus guentheri* M<sub>1</sub> collected from wild Israeli barn owl pellets. Finally, we compare the distribution of dental ecometrics of voles from the early Pleistocene site of 'Ubeidiya, Israel to evaluate if we can apply mesowear as a robust paleoecological proxy.

Results suggests that in laboratory raised vole species (n=57) there is no difference between male and female mesowear values (t=0.53913, df=30.271, p-value=0.5937 for meadow voles and t=1.0398, df=53.855, p-value=0.3031 for prairie voles). Moreover, there is no difference in mesowear values between species (t=-0.4357, df=40.483, p-value=0.6654 for females and t=0.25261, df=46.428, p-value=0.8017 for males). Critically, the distribution of mesowear values is not normal (Shapiro-Wilks W=0.6344, p-value<0.001), and mesowear values (n=20) do not correlate with skull length (r<sub>s</sub>=0.05, p-value>0.05), skull width (r<sub>s</sub>=-0.26, p-value>0.05), snout length (r<sub>s</sub>=-0.08, p-value>0.05), brain case length (r<sub>s</sub>= -0.03, p-value>0.05) and skull length by brain case length ratio (r<sub>s</sub>=0, p-value>0.05) and skull width by snout length ratio (r<sub>s</sub>=-0.004, p-value>0.05). This suggest that size and bite force do not affect mesowear values. In contrast, mesowear values of Israeli voles (n=66) are normally distributed (Shapiro Wilks W=0.98, p-value=0.72), and correlate with mean annual rainfall (R<sub>s</sub>=-0.25, p-value=0.07), maximum June rainfall (R<sub>s</sub>=0.29, p-value=0.03), minimum January rainfall (R<sub>s</sub>=0.31, p-value=0.01, minimum January temperature (R<sub>s</sub>=0.27, p-value=0.03) and seasonality (R<sub>s</sub>=-0.37, p-value=0.003).

11 M<sub>1</sub> identified as *Lagurus arankae* from the site of 'Ubeidiya (early Pleistocene, Israel) were compared to the modern vole populations. The average mesowear value for 'Ubeidiya was 81.25±4 and was higher compared to Israeli voles (79.343±3.62) but not significantly so. Both were significantly higher than the lab raised vole (76.83±4.42; ANOVA F=7.6, df 2, p-value=0.008).

Mesowear can be apply to fossils teeth with unknown age, sex or size, and is a good proxy for climate and environment. We attribute lower mesowear values to warmer and dryer conditions, indicating 'Ubeidiya was cooler and wetter than today.

## New palaeoecological investigations based on herpetofauna at the Hoxnian East Farm Barnham site (UK)

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### Abstract

The Lower Palaeolithic site at East Farm, Barnham (UK) is archaeologically important because of its stratified Acheulian and Clactonian industries firmly dated to the Hoxnian interglacial. The deposits are assigned to the early part of the Hoxnian interglacial stage (Marine Isotope Stage 11e), at approximately 425-390 Kyr BP. This interglacial stage is one of the longest and warmest periods of the last 800 000 years; at this time conditions were suitable for southern species to colonise as far North as Britain, which was still connected to the continental mainland.

The sediments preserve a vertebrate assemblage that includes one of the richest collections of Pleistocene amphibians and reptiles known from northern Europe (more than 10 000 remains). A verification of osteological attributions of the palaeoherpetofaunal material (1989-1994 excavations) done by J. A. Holman has been undertaken in 2022 and 2023, as well as a quantification of the Minimum Number of Individuals and analysing the taphonomy of the accumulation. The revised faunal list includes the Great Crested Newt (*Triturus cristatus*), the Palmate Newt (*Lissotriton* cf. *L. helveticus*), the Smooth Newt (*Lissotriton* cf. *L. vulgaris*), the Common toad (*Bufo bufo*), the Common Tree Frog (*Hyla* cf. *H. arborea*), the Moor Frog (*Rana arvalis*), the Common Frog (*Rana temporaria*), the Pool Frog (*Pelophylax lessonae*), the European Pond Terrapin (*Emys orbicularis*), a Lizard (Lacertidae indet.), the Slow Worm (*Anguis* gr. *A. fragilis*), the Grass Snake (*Natrix* gr. *N. natrix*), the Aesculapian Snake (*Zamenis longissimus*), the Smooth Snake (*Coronella* cf. *C. austriaca*), and the Common European Adder (cf. *Vipera berus*). Besides some actualizations of the taxonomical nomenclature, this study represents the first mention of *Pelophylax lessonae* and *Coronella austriaca* for the site, as well as, the elimination of the Natterjack Toad (*Epidalea calamita*), the Green Toad (*Bufo viridis* s.l.), and a Viperine Snake or Dice Snake (*Natrix maura* or *tesselata*) from the former faunal lists.

The Mutual Ecogeographic Range method has been applied to estimate temperature and rainfall for the Hoxnian. The results provide the basis for new palaeoenvironmental and palaeoclimatic reconstructions and establish a more secure basis for understanding the ecological context of the human occupation at the site, but also provide interesting data on the re-colonization process by amphibians and reptiles of the British Isles after a glaciation.





# Dental phenotype of *Lasiopodomys anglicus* from selected Middle Pleistocene to Holocene sites from Czech Republic and Slovakia

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## Abstract

History of the recently extinct European narrow-headed vole (*Lasiopodomys anglicus*), the European middle to late Pleistocene vicariant of *Lasiopodomys gregalis* clade, a dominant small mammal species of steppe-tundra environment in the whole Northern Eurasia, is a topic of considerable significance.

Presented study is a meticulous evaluation of a morphology and morphological variability of the narrow-headed vole's first lower molar within and between selected populations of Czech Republic and Slovakia with aid of geometric morphometrics methods of 2D landmarks scheme. Geometric morphometrics, based on multivariate statistics and geometry, offer various statistical tools addressing specific biological questions.

Concerning the stratigraphic distribution of the species we paid particular attention to its appearance in continuous faunal sequences enabling to confront its abundance dynamic with patterns of community development. The continuous sedimentary series provides a possibility to control the course of faunogenetic events by superposition, supplementary paleoenvironmental information and allow for cross control of the sedimentation dynamics in each site. In diverse regions of Czech Republic and Slovakia, such rich and reliable fossil record is available from more than 90 series, which allows detailed comparisons. Particular attention was given to a large population in the site Šarkanica, well dated to a peak stage of the Last Glacial Maximum (MIS 2). The variation pattern of the LGM population was compared to those in the earlier stages: Stránská Skála Cave (Moravia, MIS 14), Tučín (Moravia, MIS 6), Bojnice (Slovakia, MIS 5-4), Bišilu (Czechia, MIS 3), Balcarka (Moravia, MIS 3), Zkamenělý Zámek (Moravia, MIS 2/3), and those representing the late Vistulian / early Holocene stages: Holštejnská (Moravia), Maštalná (Slovakia), Muráň (Slovakia), Srnčí (Moravia).

In total 3 168 specimens were analyzed and biometrically evaluated, yet due to fragmentation of some, only 1 524 specimens could be used for geometric morphometrics analyses. Principal Component Analysis (PCA) indicates that the most morphological variability is associated with the width of the posterior loop, complexity and length of the anteroconid complex, width and length of the anteroconid complex and confluence of the fifth and sixth triangle. PCA's results were confirmed by factor analysis on the whole obtained dataset. Within the study we observed trend of development of the buccal prism (T6) on the anteroconid towards the Last Glacial Maximum. After the Last Glacial Maximum, we observed increased tendency towards the isolation of the buccal prism (T6) on the anteroconid.

# The Last Glacial Maximum impact in Iberia: the small-mammal assemblages from Mollet III (Southwestern Europe)

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## Abstract

The Last Glacial Maximum (LGM) is a crucial period for understanding human population dynamics and the adaptive capacity of our species. Given its long definition (30,000 to 17,000 years BP), in the Mediterranean area of Iberia the LGM includes the Gravettian (31,000-24,000 cal BP) and Solutrean (24,500-19,500 cal BP) techno-cultures, covering the transition from MIS3 to MIS2 (27,800 years BP). The Gravettian expansion coincided with global cooling and aridification, which may have caused human groups to retreat to refuges in the southern peninsulas, such as Iberia, which intensified during the Solutrean. Genetic evidence points to Iberia as a potential genetic refuge for human groups that could have maintained a stable population before, during and after the LGM. A precise characterisation of local and regional climatic dynamics is essential to understand human resilience during this critical period and to assess the experience of climatic impacts in Iberia, where the exact timing of deteriorating climatic conditions is not well documented.

Mollet III belongs to Reclau Caves (Serinyà, NE Iberia), this karstic system hosts archaeological evidence of human presence from the Upper Palaeolithic to the Middle Palaeolithic in different caves (Arbreda, Reclau Viver, Pau, Cau del Roure and Mollet). In particular, Mollet III presents archaeological deposits associated with the Gravettian and Solutrean periods, as well as some of the oldest human remains associated with the Upper Palaeolithic in Iberia. This research presents a complete climatic and ecological reconstruction based on a new taxonomic analysis of small mammals within the levels associated to these two chrono-cultural periods. During both periods, a clear dominance of two species, *Microtus arvalis* and *Microtus agrestis*, has been documented, linked to the presence of other species having Eurosiberian requirements (*Microtus oeconomus*, *Chionomys nivalis*, *Terricola gerbei*), more related to open areas. The presence of these species is frequent in Iberia, but this high dominance (>60% in all levels) is generally associated in Iberia with landscape openings or aridification. The presence of Mediterranean elements is also detected in the site (mainly, *M. Terricola duodecimcostatus*), but inferior compared to their extensive presence in MIS3 northeastern Iberia assemblages.

These results are integrated by a multidisciplinary approach combining other environmental proxies and new discoveries in the Reclau caves (pollen, charcoal, large mammals and use-wear analysis). The results are consistent with those observed in contemporaneous levels in the nearby Arbreda cave. Ongoing stable isotope analyses of faunal remains in the Reclau Caves, both small and large mammals, provide a precise means of detecting climatic changes and quantifying their magnitude. They have shown that the environmental change in the area seems to be more pronounced during the Upper Palaeolithic, from the beginning of the Aurignacian, with a progressive climatic deterioration, which is pronounced during the Final Gravettian. The aim of this study is to provide new insights into the characterisation of small mammal population shifts, considering the usual trends during the Late Pleistocene, and to shed light on the climatic evolution during a particular cold global period (LGM) in an area traditionally considered as a refugium, in order to assess whether a climatic change, abrupt or progressive, occurred regionally between the Aurignacian and the Solutrean.

# Bringing the Quaternary fossil record of order Chiroptera up to date in the Iberian Peninsula and the Balearic Islands

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## Abstract

The study of ancient bat populations employing their fossil record can be a valuable source of contextual information for modern-bats conservation research. Since the population size and distribution range of this group of mammals is decreasing rapidly all along Europe, a better understanding of how environmental and climate changes have affected bat communities in the recent geological past is a key issue. Here we present an updated and comprehensive review of all the published fossil bat records in the Iberian Peninsula and the Balearic Islands with Quaternary age. Also, this work represents a first attempt to standardize and bring up to date the criteria for the identification and counting of bat species in southwestern Europe during this period. The collected information considers 120 different fossil bat assemblages coming from 98 palaeontological sites in Spain, Portugal and the UK. The data show that the record of this group in the area is fragmentary and strongly linked to sedimentary accumulations in caves and karstic fissures. Thus, a strong preservation bias towards colonial cave-dwelling bats exists (moreover, towards bats with a tendency to form large clusters), while species with alternative ecological requirements are less frequently represented. Despite these limitations, our work raises four main points of interest. Firstly, it reveals that most of the bat species inhabiting the area under study nowadays were already present in the region since the Middle Pleistocene (or, at least, some representatives of the cryptic species complexes to which they belong). Secondly, we observe a frequent association between certain cave-dwelling bats (*i.e.*, *Rhinolophus ferrumequinum*, *Miniopterus schreibersii* and *Myotis myotis*) that is still observed in many caves today. This reflects a stable ecology that has remained undisturbed despite past climatic changes. Thirdly, a reduction in some common components of the Iberian Quaternary bat fossil assemblages is observed at the ending Late Pleistocene and the Holocene, involving the *Rhinolophus* species and *M. schreibersii* (most of them are bats with strong Mediterranean affinity nowadays). Remarkably, the Late Pleistocene and the Holocene are the periods with the greatest number of accessible data among the considered set. They are also better documented than the earlier ones (*i.e.*, the Early and Middle Pleistocene) in terms of the palaeoenvironmental information and the absolute dating available. All this allows us to relate reliably these reductions in some Mediterranean-linked bats with particular cooling events, such as the Late Glacial Maximum and the Northgrippian Neoglacial. Finally, when comparing the fossil record from the Balearic Islands and that from the peninsular territory, some peculiarities of the island fossil bats have been revealed too. The Balearic record shows some interesting palaeobiogeographical characteristics, such as unique records of some eastern taxa that otherwise are absent in the Iberian Peninsula (*Rhinolophus variabilis* and *R. cf. blasii*). Also, an unusual abundance of *R. hipposideros* in comparison to other taxa is recorded there. This synthesis work provides a compilation of paleontological data of great value for contextualizing future studies on the ecology, evolution and conservation of bats, not only in the Iberian Peninsula but in the whole of Europe.

# Evolutionary history of the Altai grey vole, *Microtus obscurus* (Rodentia: Cricetidae) reconstructed using modern and ancient genomes

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## Abstract

Altai Grey vole (*Microtus obscurus*) is a rodent species present in Western Asia, Eastern Europe, and the Near East. The taxonomic relationship of *M. obscurus* with its sister species *M. arvalis* is a matter of ongoing debate and a lack of agreement regarding the date of their divergence. To further understand the evolutionary history of *M. obscurus*, we generated partial mitogenomes of 5 modern and 11 ancient specimens from Eastern Europe and the Near East, representing all major mtDNA lineages. We reconstructed a tip-dated phylogeny using a 4.3 kb fragment of mtDNA, and a dataset of directly radiocarbon-dated samples to calibrate the molecular clock. We estimated the time to most recent common ancestor of *M. arvalis* and *M. obscurus* to be 130 thousand years ago (ka) correlating with the Eemian (Mikulino) interglacial (MIS 5e; 124–119 ka), a period characterized by the reduction of open habitats suitable for microtine species. We recorded a population turnover on the Lesser Caucasus likely related to environmental changes at the end of the Pleistocene. Using 3 published and 3 newly generated nuclear genomes we confirmed the general population structure and divergence times inferred from mtDNA. We reconstructed the demographic history of the Altai Grey vole, which revealed contrasting trajectories for the two main lineages.

# New insights on the use of enzymes for the optimal recovery of tortoise remains for the IPHES-CERCA (Tarragona, Spain) reference collection

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## Abstract

The cleaning of bones is a common practice in forensic science, zoology, anthropology, archaeology, and palaeontology. It is used to gain insights into topics such as criminal cases, the skeletal structure of new species, or the taphonomic processes affecting animal carcasses. At the Catalan Institute of Human Paleocology and Social Evolution (IPHES-CERCA), we use bone cleaning to expand the Osteological Reference Collection, which provides material for comparison with archaeological and palaeontological samples. Recently, we implemented a very useful technique: maceration with the enzyme Neutrase®.

Neutrase® is an endo-protease obtained from the bacterium *Bacillus amyloliquefaciens*, used in the food and non-food industries to process animal by-products. For our purposes, this methodology is extremely useful as it breaks down peptide bonds between amino acids, resulting in the breakdown of protein. In consequence, any organic matter joined to bone detaches and leaves a clean surface. The advantages of this technique include minimised odour, less aggressiveness to the bone, cleaner results, and shorter treatment duration, speeding up the process by days or even months. However, there are a few disadvantages related to acquisition and maintenance: the enzyme needs to be acquired, kept in a refrigerator at approximately 5 °C and, in order for it to function correctly, maintained at approximately 50 °C working temperature.

At the Micropalaeontology Laboratory of IPHES-CERCA, Neutrase® has been used for processing non-decomposed birds, reptiles, and mammals, continuously searching for a less aggressive treatment of the bones. Since no effective protocol for fresh tortoise carcasses had been established, this work aims to explore different strategies for this group. In this abstract, we present the preliminary results obtained from experiments conducted on seven specimens (juveniles and adults) of Hermann's tortoise (*Testudo hermanni*). They were treated with various methods, combining cold-water maceration, warm-water maceration, simmering, boiling, mechanical cleaning, and enzyme maceration. One objective was to find a way to preserve an intact shell without the protective cover of keratinous scutes. This was challenging due to the unique anatomy of tortoises, as access to the internal organs, pectoral and pelvic girdle is obstructed by the shell. Thus, no evisceration or separation of the limbs and head could be performed before treating the specimens with simmering water (approx. 96 °C). Special caution was required to prevent separation of the bony plates of the shell.

We found that simmering was an essential step in the preparation process for tortoises: it facilitates the separation of the head and limbs from the body, which opens up the abdominal cavity for evisceration without harming the shell structure. Additionally, it enables enzyme treatment, as they are not effective with raw flesh under the conditions we established for the experiment. The specimens are then exposed to a cycle of enzyme treatment (i.e., 10 hours at 52 °C in enzyme solution with water at a 1:83 ratio). Minimal effort is required to mechanically clean the head and limbs afterwards. It might be necessary for the shell to undergo another cycle of simmering and enzyme treatment to give satisfactory results, followed by the removal of the keratinous scutes and the consolidation of the bony plates (e.g., with Paraloid).

In summary, our results suggest that the combination of simmering, maceration with Neutrase® and mechanical cleaning is the best way to preserve an intact tortoise shell.



Here, we propose to go further in such a step-by-step comparison between the different microvertebrate groups recovered in these two localities, in order to produce some predictive patterns for the future excavation strategies and the complementation of the microvertebrate record at Camp dels Ninots.

## Small vertebrates from the Early Pleistocene human bearing level TE7 (Sima del Elefante, Sierra de Atapuerca, Spain)

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### Abstract

The Sima del Elefante site at Sierra de Atapuerca is a filled cave with 25 m deep and 15 m wide sediments infill. The infilling section of the cavity is composed by 16 stratigraphic units, named TE7 to TE21, from the bottom to the top. In the oldest of these units known to date, TE7, a human mid-face has been found in 2022. Being, until now, one of the oldest human remains found in western Europe.

In order to establish a chronological and environmental approximation of these human remains, in the field campaign of 2022 at Sierra de Atapuerca, 2.5 tons of sediments have been processed coming from the square where the human remains were found and the surrounding ones. Different taxonomical groups of small vertebrates have been identified from these picked up recorded sediments. The recovered and analyzed remains document a total of 35 taxa, including: one fish (*Salmo trutta*), four anurans (*Alytes obstetricans* s.l., *Epidalea calamita*, *Bufo bufo* s.l. and *Rana* sp.); three squamates (*Anguis fragilis*, *Coronella* cf. *gironica* and *Vipera* sp.); nine birds (*Anas crecca*, *Palaeocryptonyx donnezani*, *Columba livia/oenas*, *Aquila* sp., *Haliaeetus albicilla*, *Falco* sp., *Corvus pliocaenus*, *Turdus viscivorus/pilaris* and *Turdus philomelus/ilicinus/merula*); five eulipotyphlans (*Beremendia fissidens*, *Asoriculus gibberodon*, *Sorex runtonensis*, *Sorex (Drepanosorex) margaritodon* and *Crocidura kornfeldi*); four bats (*Rhinolophus mehelyi*, *Myotis myotis*, *Myotis* sp. and *Miniopterus schreibersii*) and nine rodents (*Allophaiomys lavocati*, *Allophaiomys nutiensis*, *Allophaiomys burgondiae*, *Arvicola jacobea*, *Ungaromys nanus*, *Pliomys simplicior*, *Apodemus* sp., *Castillomys rivas* and *Eliomys* sp.).

Chronologically, the association of rodents from TE7 can be placed on the middle part of the Calabrian stage (Early Pleistocene), corresponding to the *Allophaiomys lavocati* biozone, with an approximate age between 1.4 and 1.2 Ma.

In general, the small vertebrate assemblage of TE7 indicates a landscape dominated by open forest formations in a humid environment, with a mature river with well-oxygenated and cold running waters in the vicinity of the cavity. The open forest formations are mainly indicated by the presence of *C. pliocaenicus*, *A. fragilis*, *Rana* sp., *B. bufo* s.l., *M. myotis*, *Apodemus* sp. and *C. rivas*. The humid environments are mainly represented by the red-toothed shrews of genus *Sorex*, *B. fissidens* and *A. fragilis*, *Rana* sp., *B. bufo* s.l. The water courses are mainly indicated by the presence of the brown trout (*S. trutta*), anseriformes, the white-tailed eagle (*H. albicilla*), extinct water vole *A. jacobea*, and the extinct water shrew *A. gibberodon*.

# The small mammal assemblage of Biniadrís cave (Menorca, Spain): a preliminary approach

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## Abstract

Biniadrís cave is a small natural cavity (ca. 18 m<sup>2</sup>), located in the south-east of Menorca (Balearic Islands, Spain). This cave is part from the funerary complex of Calescoves where other caves of later chronology were already excavated. Biniadrís stands as the fourth funerary cave that is under excavation, along with the famous sites of Es Mussol, Es Càrritx or Pas. In this context, Biniadrís stands out for the abundance as well as the unique level of preservation of its findings. The space was used as a place for burial and, to date, more than 140 individuals have been recovered, in association with textile fibers, personal ornaments, pigments, wooden tools, and ceramics. The space was highly organized and it testifies to the high ritualization of the burials and the extreme care for the deceased. Radiocarbon dates indicate that it was in use between ca. 1200- and 500-years BCE.

Here, we present the preliminary data on the small mammal assemblage from Biniadrís, and the perspective for potential future studies. One species of Eulipotyphla (*Crocidura suaveolens*) and five species of Rodents (*Eliomys* sp., *Apodemus sylvaticus*, *Mus musculus*, *Mus spretus*, and *Rattus rattus*) have been identified, for a total of 490 NISP, corresponding to 190 MNI.

The dormouse *Eliomys* sp. from Biniadrís displays a larger size than both the *E. quercinus* present in the comparative collection of the University of Tübingen, and the *E. quercinus* recovered from modern-day pellets collected at the site. The larger size could be the effect of the lack of competitors and/or of strong predators in the island. Nevertheless, the morphology of the mandible strongly resembles that of the giant dormouse *Hypnomys morpheus*, although the species is already supposed to be extinct by 2040 cal. BC, least in Mallorca.

The occurrence of the common rat *Rattus rattus* is also interesting. Based on dental wear, all age classes are represented in the samples of Biniadrís cave (i.e., juvenile, adults, and senile individuals), indicating not a sporadic presence, but a resident population. Specimens were selected from different sectors and stratigraphic units to obtain radiocarbon dates and to contribute to the debate about the possible early colonization of the Balearic Islands by the species.

Finally, the study of the modern-day pellets serves both as a direct comparison with the archaeological assemblage and as a non-invasive method to survey current rodent populations and barn owl *Tyto alba* diet in Menorca.

# Snakes from the Late Natufian burial site of Hilazon Tachtit Cave (northern Israel): First results and archaeological implications

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## Abstract

In the southern Levant, the Natufian (~15,000–11,500 cal BP) represents a dynamic period in human history, characterized by pronounced socioeconomic and cultural transformations such as increased sedentism, and the intensification of foraging strategies, artistic manifestations, and burial and ritual activities, that eventually led to the adoption of Neolithic lifeways. One of the most notable aspects of the Natufian period is the increase in the number of burials, and their concentration in well-defined areas and/or cemeteries. Most archaeologists agree that interment rituals and other associated events contributed to the solidification and negotiation of social relationships, and the alleviation of tensions arising from living in increasingly aggregated and permanent villages. Located in the Mediterranean hills of the Lower Galilee region (northern Israel), Hilazon Tachtit Cave was used as a cemetery by Late Natufian communities around 12,000 cal BP. Excavations at the site have unearthed at least 28 individuals, including a burial of an elderly woman, who has been interpreted as a shaman based on her special treatment at death including unique offerings in her grave. Alongside the human burials, myriad artifacts, and other faunal remains, we have recovered a large assemblage (>2,000) of snake bones. Yet, little is known about these snakes or how they relate to the rest of the finds, funerary structures, and depositional contexts. Here we report the first results of the taxonomic and taphonomic analysis of the snake remains from Hilazon Tachtit to portray (1) which species of snakes are present at the site, (2) their habitat preferences and paleoenvironmental implications, and (3) the primary agent of accumulation.

The assemblage consists mainly of lamprophiid and colubrid snakes. In terms of species-specific identifications, the most abundant taxon is the eastern Montpellier snake (*Malpolon insignitus*), followed by the black whipsnake (*Dolichophis jugularis*). To a much lesser extent, we recorded blotched snake (*Elaphe sauromates*), coin-marked snake (*Hemorrhoids nummifer*), dice snake (*Natrix tessellata*), and Schokari sand racer (*Psammophis schokari*). A small number of viper remains is also present, most likely belonging to the Palestine viper (cf. *Daboia palaestinae*). Currently, all the snake species recovered from Hilazon Tachtit can be found in the surrounding landscape of the cave, which comprises a mosaic Mediterranean environment, characterized mostly by grass and shrublands (i.e., Mediterranean maquis), along with some scattered patches of alluvial valley vegetation and forest. The habitat preferences of the snakes complement previous paleoenvironment data obtained from the site. Regarding bone surface modifications, signs of digestive corrosion are rare, indicating that neither birds of prey nor carnivores were responsible for the accumulation of the snakes at Hilazon Tachtit. As a result, we propose that the Natufians introduced them as part of ritual interments, although, future work must conclusively demonstrate that the snakes recovered from human burials do not constitute cases of natural entrapment and *in situ* death. Our study offers new insights on human-snake relationships and their potential role in Late Natufian burial and ritual practices during the early stages of the transition to agriculture.

# Evolution of tooth complexity in voles through time and the necessity of accurate identification of highly variable morphologically close species

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## Abstract

Accurate species identification of fossil remains is a complex task essential to better understand the evolutionary history and paleobiogeography of species. During the Quaternary, voles were abundant in the northern hemisphere and they are considered as good climatic markers. Their taxonomic attribution is usually based on the first lower or third upper molars. In the case of morphologically close species, the large morphological variation can lead to some confusion, and decision making could be quite subjective. The first lower molar tends to become more complex over time by adding new triangles, making species identification even more difficult. This is the case between the common vole *Microtus arvalis* (Pallas, 1778) and the field vole *Microtus agrestis* (Linnaeus, 1761). Moreover, at an intra-specific level, recent molecular data suggest that present-day *M. agrestis* populations are a complex of divergent lineages, some of them being recognized nowadays as valid species (*M. lavernedii* and *M. rozianus*).

This study presents a morphometrical approach to statistically differentiate these species complexes based on the description of the first lower molar using landmarks and semi-landmarks. The model is based on a very large sampling of extant populations over western Europe, and is applied on fossil populations. An extensive knowledge of the intra-specific variation allows for more correct taxonomic identifications of both present-day and fossil species. Discrepancies with historical classification of fossil sites suggest that taxonomic revisions could be necessary in some case, and that faunal listings should be observed with cautious. The problem lies in the complexity trend observed on the tooth of *M. agrestis*. Whereas present-day morphologies of the two species could be precisely discriminate, species divergence is smaller and older fossils of *M. agrestis* resemble more closely to *M. arvalis*. Our study attests the contribution of geometric morphometrics to a better understanding of small mammal communities and its implication in paleoenvironmental reconstructions.



# History and range dynamics of the Nectogaline shrews in Central Europe

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## Abstract

History of shrew clades composing the tribe Nectogalini (including the European genus *Neomys*) is only poorly comprehended, due to fragmentarity of their fossil record and also incompatibility of the discrimination criteria applied in extant taxa with actual character availability in fossil material. Thus, we conducted a thorough biometric reexamination of extant taxa (144 ind. of *N. fodiens* and *N. milleri*, 45 ind. of Asiatic forms) with aid of 217 metric variables which allowed us to establish a series of discrimination criteria applicable to fragmentary fossil record. We analyzed 112 fossil items available from MN15 to Q4 sites of the Czech Republic and Slovakia. A rich sample from the present glacial cycle (MIS 5b to Recent) demonstrated that both *N. fodiens* and *N. milleri* colonized the region of Central Europe either in earlier stages of Vistulian glacial, in early post-LGM glacial and throughout whole Holocene (though their distribution patterns were perhaps mostly mosaic in both species). The items from the late Biharian (Q2) and the earliest Middle Pleistocene (Q3) were found to represent a single clade characterized by relatively broad phenotype variation. This form, belonging clearly to the genus *Neomys*, was coidentified with *Neomys newtoni* Hinton, 1911. The pattern of its phenotype variation suggests that it might represent a source taxon for the morphoclines resulting in the extant *N. fodiens* and *N. milleri*. The expected divergence (in Middle Pleistocene, Q3) corresponds to upper divergence limits proposed by molecular phylogenetics. The items recorded from MN15 (middle Pliocene) to Q1 (early Biharian) sites correspond well to phenotype pattern of the Pliocene genus *Asoriculus* Kretzoi, 1959. Yet, some items from late MN17 and Q1 show tendencies indicating a possible *Asoriculus-Neomys* transition. We separate them under the name *Asoriculus castellarini* (Pasa, 1947). A detailed comparison of my fossil material with samples of extant Asiatic taxa revealed a variation homogeneity of the European group *Asoriculus – Neomys* with distinct differences from the genus *Episoriculus*. A special attention was devoted to the European Q2-Q3 taxon *Macroneomys brachygnathus* Fejfar, 1966, reported already from 11 European sites, all along the Q2/Q3 transition. The analysis of the type series of this form revealed a close relation to extant Asiatic form *Soriculus nigriscens*. For *Macroneomys*, this suggests a paleobiogeographic scenario expecting a spread from Asia during the Early/Middle Pleistocene Transition.

# Spatial variation in tooth morphology of ground squirrels as a tool for palaeobiogeographical reconstructions

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## Abstract

It is well known that mammal teeth have low environmental variance. Thus, any change (any between-population difference) in tooth morphology may be considered as a phylogenetic signal... unless this change is not the result of immigration. Since the tooth obviously is inferior to DNA in degrees of freedom to change, phylopatry of the species in this case is even more important than in average. Ground squirrel species, due to peculiarities in their ecology and behaviour, closely meet the requirements to suitable model objects for biogeographical reconstructions. Here we consider two ground squirrel species that occurs in present in the Central Europe, *Spermophilus citellus* and *S. odessanus*.

*S. odessanus* has been occupying its present range, the steppe and forest steppe to the west from the Dnipro River, since the Middle Pleistocene. The only changes were oscillations of the northern range boundary, because of glacial/interglacial cyclicality.

*S. citellus*, to some extent archaic and rather thermophilous species, was restricted to southern Europe in the Pleistocene, while the northern part of its present range was occupied by extinct ground squirrel *S. citelloides*. Only the Early Holocene warming (c. 10 ky) allowed the spread of *S. citellus* northward. Later on (c. 5 ky), the agricultural transformation of landscape caused the expansion of the species further to the north, in agriculturally deforested areas. The Subcarpathian isolate of *S. citellus* appeared far later, c. 15-16 century (subfossil small mammal remains together with large mammals and Medieval archeological findings in Voronkovskiy Cave).

The last stage of range expansion (common to all European ground squirrel species) was triggered by the massive ploughing on 19<sup>th</sup>-20<sup>th</sup> century. At that time, *S. citellus* reached southern Germany and southern Poland; an isolate of *S. odessanus* appeared in eastern Poland.

We assume that expansion caused by agricultural transformation of landscapes (in particular, this last, 19<sup>th</sup>-20<sup>th</sup> century) does not increase the spatial variability in tooth morphology to such extent as “natural” expansion that unfolds in highly mosaic environment. For ground squirrels, the difference between these two kinds of expansion we expect to be higher because they have numerous restrictions with respect to dispersion and settling. To test this assumption, we compared Southern German ground squirrel population of *S. citellus* (“agricultural”) with Subcarpathian Ukrainian population (“natural”) and Belarus and Lublin populations of *S. odessanus* (“agricultural”) with several samples of this species from the Ukrainian area (“natural”).

The results show that “agricultural” populations of *S. odessanus* (Belarus and Eastern Poland) are quite close to the Ukrainian representatives of species (the core of the species) in their occlusal morphology. In contrast, difference between studied samples of *S. citellus* (German and Ukrainian) is significant. Ukrainian *S. citellus* lack one of the cusps of the occlusal surface of the lower teeth, the metastilid, which has found in German ones and is expected to be common in other populations of the species. The most likely explanation is the bottleneck effect due to overcoming of the barrier, which Carpathians and the lower flow of the Danube pose to the dispersion of steppe mammals. In the case of *S. citellus*, a sufficient regional coverage is very far from being achieved yet; tooth morphology of this species, with its disjunctive range, needs further study. Still, the present results support the idea of the difference in the population morphological response between “agricultural” and “natural” of expansion in ground squirrels.



14.1%, higher than in protocol 1. The dominant grade of digestion is the light one (52.6%), followed by the moderate (19.23%) and in a smaller proportion the heavy (7.7%) and extreme one (2.6%).

Preliminary observations regarding enamel and dentine loss suggest that enamel and roots are more susceptible to damage compared to dentine. This distinction is crucial for accurate specimen identification and for discriminating mixed assemblages.

This study presents an innovative methodology that opens high resolution taphonomic results and shows the effects of aggressive conditions. Neotaphonomic investigation presented serves as a case study with potential for broader application. A comprehensive understanding of the influences exerted by diverse taphonomic agents is pivotal for advancing our knowledge of fossilization patterns and processes, thereby significantly impacting the field of paleontology and archaeology.



# Amphibians and squamate reptiles from the Early Pleistocene site of Pirro Nord 13 (Apricena, Italy): preliminary palaeoecological reconstructions

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## Abstract

The Early Pleistocene site of Pirro Nord 13 (PN13), dated between ca. 1.6 to 1.3 Ma, is one of the fissures that conforms the karstic complex of the Pirro-Dell'Erba quarry (Apricena, Foggia, southern Italy). This system is well known for its rich palaeontological record that has given its name to the last Faunal Unit (FU) of the Late Villafranchian (Pirro FU). Among the studied localities, PN13 is the unique that evidences human presence, attested by the documentation of lithic artefacts together with butchering marks on faunal bones. These evidences represent one of the oldest human records of Western Europe, together with the Spanish sites of Barranco León and Fuente Nueva 3 (Orce, Granada), and Sima del Elefante - TE7 (Atapuerca, Burgos). Previous palaeoecological analyses undertaken for the Pirro Nord fissures (not including PN13) suggest cold conditions, reflecting stronger continentality, lower temperatures, and higher rainfall than today in southern Italy, with a predominance of open-dry biotopes. The aim of the present work is to produce palaeoecological reconstructions for the PN13 locality on the basis of its amphibian and squamate reptile assemblage.

The amphibian and squamate fossil remains analyzed for this study consists of disarticulated elements collected by water screening of sediment obtained during the excavation campaigns of 2007 and 2008 at the PN13 site, deposited in the Dipartimento di Scienze della Terra of the Università di Torino (Italy). The resulted faunal list for its herpetofaunal association is composed by a total of 14 species: five anurans (*Pelobates syriacus*, *Bufo bufo* gr., *Bufo viridis* gr., *Hyla arborea* gr., and *Pelophylax* sp.), four lizards (*Podarcis* sp., *Lacerta* sp., Lacertidae indet., and *Blanus* sp.), and five snakes (*Hierophis viridiflavus*, *Zamenis longissimus*, *Coronella* cf. *austriaca*, *Natrix natrix*, and an indeterminate colubrid).

To address the palaeoecological reconstruction for the PN13 site, the Mutual Ecogeographic Range method with the Uncertain Distribution Area-Occupied Distribution Area discrimination technique have been applied to obtain temperature and precipitation estimates, and the Habitat Weightings method to infer the surrounding environment. The preliminary results obtained, complete the ecological characterization of the Pirro-Dell'Erba quarry stratigraphical sequence, and shed light on the understanding of the ecological context of one of the first human dispersal across Europe.



# Posters

## Insights on the evolution of the tribe Pliomyini (Arvicolinae, Rodentia): Ancient DNA from the extinct *Pliomys lenki*

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### Abstract

The Arvicolinae (Rodentia, Mammalia) subfamily present one of the highest evolutionary rates of the recent history, with a total of three evolutionary radiations since the Pliocene, which makes challenging the study of its phylogeny. The first representative of this subfamily of small mammals is found in Europe and Asia, most commonly ascribed to the genus *Promimomys* [Miocene-Pliocene boundary, ~ 5.3 million of years (Ma) ago]. Arvicolinae rodents include all extant and extinct genus of muskrats, voles, and lemmings. This high evolutionary rate, together with their specific adaptations to different habitats and environments, has made of these small mammals one of the most used proxies in paleoclimatology and biostratigraphy studies of the Quaternary record. Because of their importance the partially unresolved phylogeny of the Arvicolinae subfamily has been a recurrent topic of discussion in scientific papers.

*Dinaromys bogdanovi*, also known as the Balkan snow vole, is the only extant species of the genus *Dinaromys*, being only present nowadays in the Balkan region, and one of the Arvicolinae species with an unclear phylogenetic position in the most recent studies. The morphology of its molars has traditionally been compared and related to the extinct *Pliomys* by most paleontologists, being described *Dinaromys* as a “cementum-bearing type of *Pliomys*”. The last known *Pliomys* representative, *Pliomys lenki*, persisted until the Late Pleistocene in the north of Spain and the Massif Central of France. These genera are included in the Pliomyini tribe, but some authors had included *Dinaromys* into the Clethrionomyini tribe, considering *Pliomys* as the ancestral form of *Clethrionomys*, or even in Ondatrini or Prometheomyini. Moreover, although *Pliomys* and *Dinaromys* have been morphologically related, there has always been discussion about when these genera should have separated, or what is exactly their phylogenetic relationship. Even some species of *Dinaromys* were initially classified as *Pliomys*, as is the case of *Dinaromys dalmatinus* and *Dinaromys pasai*.

We had used ancient DNA (aDNA) data from the representatives of *Pliomys lenki* of El Miron Cave, from the level 129 (46,890-33,160 years cal BP), one of the last records of this species. Our results show that: 1) *Pliomys lenki* and *Dinaromys bogdanovi* correspond to two clearly different genera, *Pliomys* and *Dinaromys*; and 2) *Pliomys* and *Dinaromys* are unquestionably related conforming the tribe Pliomyini and clearly separated from the tribes Clethrionomyini, Ondatrini and Prometheomyini. Our results located the separation of the genera *Dinaromys* and *Pliomys* around 3.8 Ma (4.9-2.6Ma), during the Pliocene, probably during the Mammal Neogene Zone 15 (MN15). With this data it is probably that the Pliomyini tribe derived from some species of *Propliomys* during the Pliocene. Moreover, some authors consider that *Propliomys hungaricus*, recorded in the Middle Pliocene, specifically during the MN15, could be the ancestor of the genus *Dinaromys*, which would be in agreement with our *Dinaromys/Pliomys* separation age.

# Forest-affinity micromammal assemblages from MIS 3 of the Cantabrian Region: Insights from the La Torca del León and La Rexidora Caves (Asturias, N. Spain)

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## Abstract

The Cantabrian Region (NW Iberia) is situated at the southwestern edge of the Eurosiberian biogeographic region. Its rugged topography features an altitudinal gradient ranging from the Cantabrian Mountains (>2500 m asl) down to the coastal plains, which consist of exposed marine terraces. These terraces have served as natural corridors for the migration of fauna and humans between Europe and the Iberian Peninsula since at least the Middle Pleistocene. Furthermore, the region's extensive karstified areas have facilitated the development of numerous caves rich in paleontological remains. The local micromammal records from the late Pleistocene are characterised by a dominance of arvicolines, indicating a predominantly open landscape. Conversely, species with forest affinities typically have an isolated and reduced presence in these assemblages.

Within this context, our study unveils two micromammal assemblages, each harbouring a rich and diverse community of species with mature forest affinities. While the Torca del León cave micromammal association portrays local and dense forested conditions, the micromammal assemblage from La Rexidora cave (this study) comprises two distinct communities: one with exclusively forest affinities and the other with open habitat preferences. Among other taxa, these assemblages include the wood mouse (*Apodemus (Sylvaemus) sylvaticus*), the yellow-necked mouse (*A. (S.) flavicollis*), the European fat dormouse (*Glis glis*), the garden dormouse (*Eliomys quercinus*), and the bank vole (*Clethrionomys glareolus*).

The fossil assemblage from La Rexidora was recovered from a chaotic sedimentary deposit, accumulated into a doline, which spans a chronology of at least 44 to 37 ka. The sediment analysed in this work comes from the surroundings of a hyena skeleton dated to 38.5–36.6 cal kyr BP, an age corresponding to Interstadial GI-8, so the micromammal community here analysed is probably of a similar age and, consequently, its forest affinity would also be compatible with the temperate conditions of this episode. However, no other MIS 3 sites in the Cantabrian Region have yielded rodent communities with such pronounced forest affinities. Therefore, the exceptional character of both associations would be motivated not only by their interstadial climatic context but also by their location close to the northern slopes of the coastal mountain ranges, which currently reach altitudes of approximately 900 and 1300 m asl. These mountain ranges, parallel to the coastline, would favour precipitation accumulation during a predominantly arid period.

# MicrOccitanie: evolution of microvertebrate communities from the Pleistocene / Holocene transition to the end of Neolithic in Occitanie (southern France)

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## Abstract

The animal communities currently present in Occitanie have largely been shaped by two main historical events. First the Pleistocene-Holocene transition, which altered the ranges of all plant and animal species, allowing temperate taxa to expand their ranges, and pushing cooler species to retreat to higher altitudes or northern areas. More specifically, it is the processes of isolation and recolonization from refuge areas that explain the composition of today's faunas. The second factor is the increasing anthropization typical of the Holocene, beginning in the early Neolithic period. Anthropization encompasses all the processes by which human populations modify or transform their environment, bringing together elements of different natures, intentionally or not (arrival of commensal species). While the importance of these two events is attested, the changes they induced in faunal communities are difficult to assess: while some major patterns are well documented (e.g. the extension of forest ecosystems at the beginning of the Holocene), it remains difficult to precisely link the faunal changes observed to a given event, whether anthropogenic or natural. What's more, a change observed on a global scale will lead to multiple, sometimes divergent, responses on a local scale. Last but not least, while the evolution of faunal communities is well known during the Pleistocene, there is a cruel lack of data for the Holocene as a whole, particularly for small vertebrates. This issue is regrettable because small vertebrates are among the most well-suited taxa to understand the impact of anthropization, whether it is on local environment or diversity.

The MicrOccitanie project aims to fill this gap. By studying various sites from Late Pleistocene to the beginning of the Bronze Age, this project will provide data from various unstudied collections of all the region. The main goal is to have an in-depth understanding of the evolution of faunal communities from that time period in different areas of Occitanie in order to understand the temporal and spatial variation of animal communities for more than half of the Holocene.

# Quaternary palaeoclimatic trends from small mammal assemblages of the Sierra de Atapuerca, Spain

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## Abstract

The fossils of small mammals are a valuable proxy for understanding climate evolution during the Quaternary. Their extensive fossil record, combined with their high reproductive and evolutionary rates, as well as specific ecological requirements, make small mammals accurate indicators of environmental changes. Several methods are commonly employed for performing palaeoclimatic studies using this proxy. Among these, the Bioclimatic Model (BM) allows for the reconstruction of quantitative and qualitative climatic conditions in the Palaearctic realm using fossil Rodentia and Eulipotyphla assemblages, including extinct species.

The complex of archaeological and palaeontological sites from the Sierra de Atapuerca, consisting on sedimentary cave infillings, have yielded an exceptional and well-documented stratigraphic record spanning from the Early Pleistocene (lower sections of the Sima del Elefante and the Gran Dolina sites) to the Late Holocene (upper sections of El Portalón and El Mirador sites). In this study, we applied the BM on the fossil assemblages of small mammals coming from the entire chronostratigraphical period represented at the Sierra de Atapuerca caves. The diachronic analysis of the evolution of these assemblages provides an updated synthesis of qualitative and quantitative long-term climatic reconstructions ranging from 1.2 Ma (Sima del Elefante Lower Red Unit, TELRU) to 3.4-3.1 cal kyr BP (level 4 of El Mirador, MIR4).

To provide bioclimatic information for the BM approach, the Climatic Restriction Index (CRI) of several extinct taxa was processed based on the geographical distribution of the morphologically closest extant species and their past geographic ranges. The results of the bioclimatic analysis indicate that a typical temperate climate (VI) dominates the entire sequence, followed by the Mediterranean climate (IV), showing overall climatic stability during the analysed time span. On one hand, the quantitative estimations indicate a warmer climate during the end of the Calabrian and Chibanian, while major variations are observed in the Late Pleistocene levels from El Portalón site, which show colder climatic conditions linked to boreal and transitional boreal-temperate climates in certain layers. On the other hand, the thermotype classification achieved shows an initial phase characterised by the supratemperate thermotype at TELRU, evolving to the second phase from the end of Calabrian and Chibanian dominated by the mesotemperate thermotype, and indicating supra- and mesomediterranean thermotypes linked to the faunal assemblages of levels TD6 and TD8 from the Gran Dolina site and the Sima de los Huesos Lithostratigraphic Unit 6. Broadly speaking, oro- and supratemperate thermotypes alternate in the assemblages coming from the Late Pleistocene levels of El Portalón (levels P16-15 to P1) and El Mirador (levels MIR50/51), except for the coldest episodes classified as transitional thermoboreal-orotemperate in levels P12 and P6-5. The Holocene assemblages from El Mirador (MIR49 to MIR4) and El Portalón (P79) indicate climatic stability associated with the supratemperate thermotype.

This scenario is in overall agreement with previous palaeoclimatic and palaeoenvironmental studies conducted using the Atapuerca palaeontological and geological record. Our results correlate mainly with interstadials of the Early and Middle Pleistocene, while the cold episodes of the Late Pleistocene linked to the Heinrich events 4, 3 and 2 (LGM) were recorded.

# Influence of food constraint on craniofacial ontogeny and covariation in rodents

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## Abstract

The craniofacial complex is an intricate structure because of its numerous constituent bones and its involvement in many essential tasks. At the same time and somehow paradoxically, this unit is highly evolvable and presents a high diversity of shapes. Epigenetic interactions in response to mechanical stimulations will compensate and coordinate the growth of the different organs constituting the head, in order to acquire and/or to maintain certain functions. During postnatal development, the different tissues making up the head will have to coordinate their spatialization to accommodate to food weaning (transition from sucking to chewing movement). These mechanical constraints can be modulated by the consistency of the feed from weaning onwards. We have raised House mice, Golden hamsters and Mongolian gerbils applying either a hard or a soft diet as soon as weaning begins. This difference in consistency may reflect variations in the hardness of feed available in nature, depending on environmental conditions at the time of weaning. We follow the ontogeny of cranium and mandible shapes and their covariation. The mandible takes longer to acquire its adult shape under soft food, whereas the skull does not seem to be affected by this difference in constraint. Although the mandible is more plastic than the skull, covariation of these two units throughout postnatal development is maintained. Mandible plasticity appears therefore a rapid adaptive response during development to the availability of food resources, without jeopardizing the functionality of the entire craniofacial complex.



downloaded from the GBIF-Global Biodiversity Information Facility, and the environmental variables were derived from WorldClim 2. We selected the Maxent algorithm with the biomod2 package in Rstudio for the model calculation. For the model evaluation and validation, we analysed classification and discrimination capacity components through the True Skill Statistic and the Area Under the Curve of the receiver operating characteristic plot, respectively. We also assessed model performance by calculating null models; we applied a Wilcoxon signed-rank test to measure the differences in the evaluation metrics between the empirical and null models. Upon obtaining the species' niche recorded at the fossil site, we applied the MER method to the small mammal association identified using R.

The climatic results of our study using the MER method with the implementation of ENMs are as follows: a Mean Annual Temperature of 11.4 °C and a Mean Annual Precipitation of 478 mm. These conditions suggest colder climates (-2,2°C) for the Neanderthal groups frequenting the site compared to the present. The integration of ENMs in the MER method, along with its execution in a designed script, has enabled us to work with mathematical approaches to the ecological niches of the species, thereby improving the precision of past climatic reconstructions, automation and reproducible results, and the ability to handle vast amounts of information.

# Biometric analysis of voles from EMPT site Koněprusy C718, Czech Republic

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## Abstract

Enormously rich assemblages of arvicolid rodents obtained from a multilayered Upper Biharian (MIS 16-18) sequence in Koněprusy C718 (MNI=13 219) was examined with aid of a detailed biometrical analysis. Standard linear ml dimensions were measured, simultaneously to geometric morphometry approach operating with 20 ml landmarks. Here we present preliminary results concerning the taxa attributed to the genus *Microtus*, i.e. *Microtus arvalinus* (n= 900), *M. coronensis* (n= 200), *M. arvalidens* (n= 400), *M. ratticepoides* (n= 600), *M. nivaloides* (n= 100), and in particular those belonging to *M. hintoni-gregaloides* clade (n= 4900). The latter was splitted into four independent OTUs (Operation Taxonomic Units, referred as *M. hintoni*, *M. schmidtgeni*, *M. gregaloides*, *M. gregalis*). With aid of multivariate analysis we examined variation patterns of particular OTUs and undertook their between-layer and between-clades comparisons. We found no distinct trends in representation and intrapopulation variation among *M. hintoni*, *M. gregaloides*, and *M. schmidtgeni* in contrast to their differences from other *Microtus* OTUs (incl. *M. arvalidens* that shares with them T4/5confluence). *M. gregalis* / *S. anglicus* phenotypes regularly appeared (in a low percentage) in the uppermost layers of the sedimentary complex.

# Biogeography of the Early/Middle Pleistocene Transition in Central Europe

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## Abstract

The Quaternary biotic history is marked by alternation of glacial and interglacial communities via extensive range dynamics of their members. This pattern, distinctly pronounced only in the middle and late Pleistocene, arose during the Early/Middle Pleistocene Transition (EMPT). We investigated course of underlying faunal rearrangements based on extensive fossil record of EMPT small mammal communities obtained from complex sedimentary sequences in the Czech Republic (64 community samples with total abundance MNI=13995). The stratigraphic alignment of particular sedimentary series enabled to express position of particular samples in terms of the MIS climatostratigraphic stages, and to reveal the faunal patterns at each of the MIS 23-14 units. Despite invariant axial structure of EMPT communities, the EMPT turnover changed a species list of Mid-European small mammals by 41 % of reported species. Most of the changes refer to phenotype rearrangements of resident taxa and split of them into elements of either glacial or interglacial communities. Yet, 6% refer to real extinctions and 16% to arrivals (particularly during MIS 21-17 stages) of apochoric clades not previously recorded. The apochoric elements were composed either by clades close to those recently resident in Himalayan region (*Macroneomys brachygnathus*, *Petauria voigstedtensis*) or those adapted to deeply pronounced seasonality of the the boreal or steppe zones (*Sorex minutissimus*, *Colobotis*, *Pteromys volans*). A reduction of diversity during the glacial stages and the alternation mode of community response toward climatic oscillations were particularly pronounced since MIS 16. The tectonic uplift during MIS 22-17, locally demonstrated by abrupt onset of deep river erosion, is considered the ultimate cause of the EMPT, associated environmental rearrangements driving the unexpected transcontinental range expansions.

# Inferring palaeoenvironmental dynamics from Late Pleistocene micromammal fossil assemblages at Lapa do Picareiro, Portugal

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## Abstract

The Iberian Peninsula is one of the most significant regions in Europe to study the development of human adaptations and changes in the environment throughout the Late Pleistocene. This region is well known as a location of refugia inhabited by Neanderthals before their disappearance. However, the cause of their disappearance remains debatable. Recent studies from sites in this region have found changes in the environment influenced the availability of resources and made conditions unsuitable for Neanderthal survival. Lapa do Picareiro is amongst the notable sites with evidence of Neanderthal occupations in this region. Lapa do Picareiro is a limestone cave site with a thick and continuous archaeological sequence ranging from the Iron Age to the Middle Palaeolithic. This site has an abundance of archaeological material (lithics, fauna, shells, and botanical remains) recovered from a 10.6 m deep section divided into 36 Pleistocene-aged strata. Approximately 2 m of deposit radiocarbon dated to ~45-35 ka cal BP corresponds to the Middle-Upper Palaeolithic Transition (MUPT).

Lapa do Picareiro yields an abundance of faunal remains (i.e. birds, rabbits, rodents, fish, herpetofauna, ungulates etc.) dated to MIS 4-2. Previous research at this site has employed multi-proxy analyses of large fauna, stable isotopes, and botanical remains to recognise changes in the palaeoenvironmental conditions covering a time range when the Neanderthal population dwindled. Stable isotope analysis of ungulate teeth (red deer and ibex) from just before the MUPT (51.8 - 42.5 ka cal BP) at the site suggests a transition from open patches of forest with dry and warm conditions during ~55–57 ka cal BP, to less dense steppe, less dry conditions and fluctuations in warm and cold temperatures during (51.5 – 42.5 ka cal BP).

A large quantity of micromammal remains are present in the deposits but have seldom been used as a palaeoenvironmental proxy at this site. Our analysis will be the first micromammal study at Lapa do Picareiro to infer the palaeoenvironmental conditions and compare our findings with contemporaneous sites in the Iberian Peninsula. The micromammal assemblage consists of material from two levels, Level JJ (51.5 - 44.4 ka cal BP, Middle Palaeolithic) and Level GG (39.6 - 38.7 ka cal BP, Upper Palaeolithic), both dated within MIS 3. The objectives of this study are to identify the taxonomic composition by analysing cranio-dental specimens and documenting taphonomic modifications on crania and post-crania in the assemblage. The taxonomic analysis will provide information on the habitat preferences and density of vegetation structures within the cave's proximity. The taphonomic analysis will share insights on site formation processes, and the potential accumulators of the assemblage. The application of the Bioclimatic and Habitat Weighting methods and diversity indices will infer the type of vegetation structures and their density, and determine the mean annual precipitation, and mean minimum and maximum temperatures in the region.

The outcome of this research will be combined with interpretations from large and small fauna, stable isotopes, micromorphology and botanical remains studied at the site from the same levels. This approach will produce a highly informative, sequenced, multi-proxy picture of the palaeoenvironmental background in which Neanderthals thrived and survived during the MUPT and throughout the Iberian Peninsula. This study expects to broaden our knowledge of Neanderthals' resilience to periods of climate and resource instability and cultural interactions with other populations.



According to these results, the palaeoclimatic reconstruction indicates that the latest Pliocene was colder and drier than the earliest Pleistocene. A shift towards a more seasonal rainfall pattern occurred from ACB-4 to ACB-1, which most likely influenced the vegetation and habitat types in the region.

According to the proposed palaeoecological reconstruction, the landscape in the surrounding area of the Almenara-Casablanca karstic complex was dominated by forest and/or scrubland during the late Pliocene (ACB-4). At the beginning of the Pleistocene (ACB-1) a turnover in the dominant habitats is recorded. Thus, the open habitats overtook forests in importance. This change is tentatively related with the establishment of the Mediterranean climate in the region, which is characterized by warm temperatures and seasonal drought. Thus, the higher seasonality in ACB-1 may explain the differences observed between the assemblages in both sites, although other factors could also be involved.

# Geographical distribution and genetic structure of a cryptic species complex in voles (Arvicolinae, Rodentia)

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## Abstract

Rapid environmental changes occurring during the last glacial periods drive complex dynamics of small mammals over Europe leading to lineage turnovers across the continent or local survivals of previous established populations. It results that numerous cryptic molecular lineages are identified in western Europe through several taxonomic groups suggesting non-adaptive radiations in relation to these climatic events. This peculiar context offers the opportunity to study how extant species have responded to previous climate changes.

Western European voles represent an interesting species model to study such interplay of evolutionary and climate dynamics. The species complex of *Microtus agrestis* is represented by three cryptic species identified recently as such: *M. agrestis* (a northern lineage), *M. lavernedii* (a southern lineage) and *M. rozianus* (a Portuguese lineage). These species have probably separated during the Younger Dryas cold event (12ky). Their identification remains nonetheless difficult without molecular data, the knowledge about the precise locations of their contact zones is scarce, and the geographic distributions poorly documented in some regions. The evolutionary processes by which they are separated and their potential of hybridization raise questions.

Our study combines molecular data and geometric morphometrics of the first lower molar to a better understanding of the mechanisms leading to their divergence and recent speciation event. Using a large dataset across western Europe, genetic structures and geographical living ranges were better circumscribed and potential contact zones identified. Furthermore, these data have allowed to establish a morphometric model to evaluate species-specific morphological features and variation of the first lower molar, which will allow taxonomic identification in fossils and track historical changes.

# Assessing the small vertebrates potential of the Northgrippian cave-site of Los Piojos (Riela, Zaragoza, Spain): preliminary results after resuming field work

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## Abstract

The Northgrippian site of Los Piojos is a small cave located in Riela (Zaragoza, Spain), on the southern flank of the Ebro River, northeast of the Iberian Peninsula. It is known by its archaeological record, remarkably the human remains and tools that evidence the sepulchral use of the cave from the late Neolithic to the Iron Age. During the fieldwork campaign of 2016, some sediment samples (dated as ending Northgrippian, 5084- 4903 cal. BP) were dry-sieved with a 5 mm mesh. More than 300 small vertebrate remains were recovered, including rodents, soricids, bats, birds, lizards and frogs. The detailed analysis of the small mammals and the birds assemblages revealed an association dominated by the presence of the field mice (*Apodemus sylvaticus*), a taxon with strong Mediterranean affinity nowadays, but with the remarkable occurrence of some cold-related taxa, specifically the circumpolar bird *Lagopus lagopus* and the montane and subalpine vole *Microtus pyrenaicus*. This assemblage with no current analogues is of particular interest, as the end of the Northgrippian in the Iberian Peninsula has been characterized as a moment of rising aridity and decreasing temperatures, based on multi-proxy analysis (such as speleothemes, ice cores or glacial geomorphology). However, no deep analysis of the small vertebrate communities in the area during this cooling event have been performed yet. Thus, during 2024, a new excavation campaign was designed to systematically recover the small vertebrate remains recorded at the archaeological level of the site. In a first assessment, three sediment samples (2 kg, 6 kg and 6 kg) from three different squares were extracted, then washed and sieved with a 0.5 mm mesh. From a total of 14 kg of sediment, around a hundred small vertebrate remains were recovered, including murid mandibles and isolated teeth, abundant postcranial remains of small mammals, Galliformes and Corvid remains, small Passeriformes ungual phalanxes, herpetofauna remains and some fragments tentatively classified as eggshells (probably from geckos or birds). Fragments of large vertebrate bones and numerous millimetric coal fragments have been recovered too, providing complementary environmental and ecological information to our research. In light of the success of this first attempt, a subsequent two-phase excavation campaign was planned for 2024. During the first phase, which took place in April, 170 kg of sediments were recovered along to several large mammal remains and one lithic tool (currently under analysis). The second phase is planned to reach the 300 kg of sediments, which will be washed and sieved also during this year, with the main objective of shedding light on the Iberian small faunal characterization during the Northgrippian cooling event.



# Fossil record of the genus *Spermophilus* in the Czech Republic and Slovakia

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## Abstract

The ground squirrels of the genus *Spermophilus* appear relatively rarely in the Central European Quaternary fossil record. Yet, thanks to relatively rich fossil record in the Czech Republic and Slovakia we recorded that genus in at least 59 localities of the Quaternary age (141 communities). In most instances the record comes from the glacial communities of the last cycle (MIS 5-1). In total, 849 items were analyzed with aid of a detailed morphometric analysis (151 metric characters).

Fragmentary evidence from the Upper Pliocene and Early Pleistocene (MN17 and Q1) includes smaller forms belonging to either *S. primigenius* or *S. nogaici*. Significantly more robust phenotypes corresponding to the characteristics of the subgenus *Colobotis* first appear in the MIS 18-16, probably because of community rearrangements related to the Middle Pleistocene Revolution. We tentatively identified these individuals as *S. dietrichii*. The major bulk of the materials referred to the subgenus *Colobotis* comes from the Upper Middle Pleistocene to Early Holocene assemblages. They seem to belong to a single species, *S. superciliosus*, which thus can be looked upon as an index fossil of glacial communities of the Upper Middle Pleistocene in Central and Western Europe.

An extensive collection of *S. superciliosus* from the loess localities of the Central and Northern Bohemia, deposited in the National Museum in Prague (630 items including complete skulls, jaws and postcranial skeleton) enabled a detailed analysis of the phenotypic variability of this form, comparison with the variation pattern of the Recent species of *Colobotis* and forms of the *S. citelloides/citellus* group. The results opened up the possibility of reliable determination of fragmentary earliest Holocene fossil record – in all cases it is *S. superciliosus*. *S. citellus* appears in Central Europe during Holocene. In Central Europe, *S. citelloides* is limited to the Pannonian region, it appears during period MIS 7-9, typically at the end of interglacials.







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