13TH ICAZ
INTERNATIONAL CONFERENCE

PROGRAMME / ABSTRACTS

2ND - 7TH SEPTEMBER 2018

ANKARA - TURKEY

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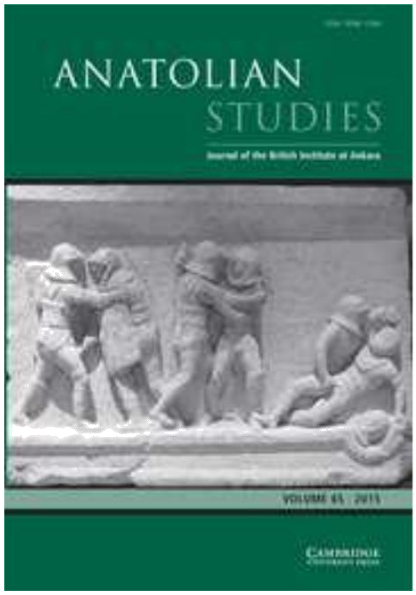

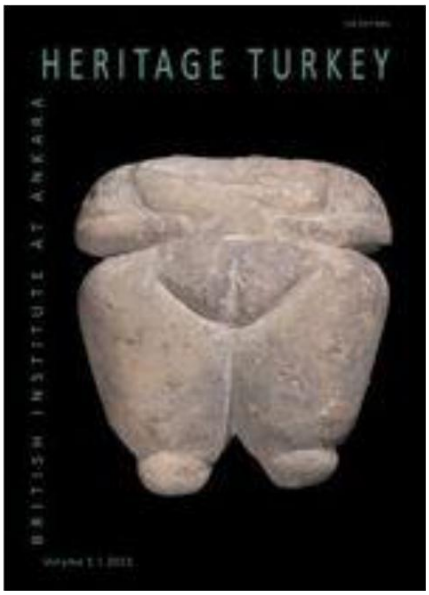

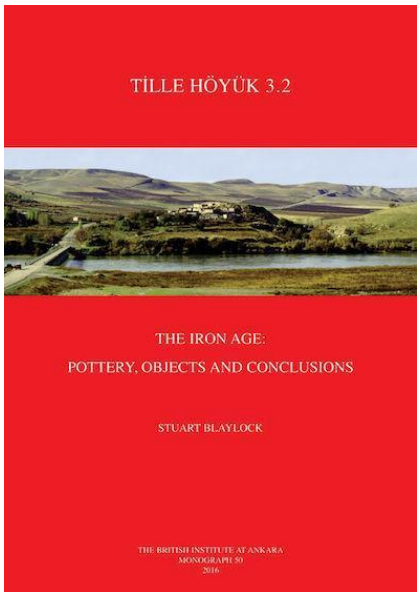

T.C.
KÜLTÜR VE TURİZM BAKANLIĞI

13TH ICAZ INTERNATIONAL CONFERENCE

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ABSTRACTS

A series of suggestions and drawings for the conference logo were submitted by METU, Ankara University and Hacettepe University students. After a vote by the members of the Scientific and Organizing Committee, the drawing proposed by Zeynep Ece Sahin was chosen. It encircles a number of bone "shadows" topped with the statue of a deer drawn after a metal find from the "Kings' tombs" at Alacahöyük. This statue is displayed at the Anatolian Civilizations Museum in Ankara.

International Council for Archaeozoology

Middle East Technical University

WELCOME TO ICAZ 2018

Straddling between two continents, as truly a bridge, Turkey is a unique country with rich and varied contemporary culture as well as numerous archaeological sites from the earliest prehistory to most recent civilizations. The rich archaeological heritage and history of Turkey always attracted the attention of archaeologists, which led to formation of multinational, multidisciplinary research teams in many excavation sites.

It is also a significant region for zooarchaeology since it holds the remains of cultures that were pivotal in the advancement and establishment of domestic animal economy and its dispersal to other localities. At the same time, throughout history, the continuous moving of people to and through the lands of Anatolia offers numerous challenging research questions to the study of animal management.

Ankara, the capital city of Turkey, lies in the steppes of Central Anatolia, which contain many of the well-known archaeological settlements. The venue, METU-CCC is conveniently located in Middle East Technical University campus with many restaurants, banks, health centre and other shops at a walking distance.

We hope the meeting will provide an unprecedented opportunity to colleagues from Turkey and abroad for sharing and discussing their research on zooarchaeology.

CONTENTS

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ACKNOWLEDGMENTS

We want to extend our thanks to the excavation directors Prof. Mihriban Özbaşaran, İstanbul University, Prof. Arkadiusz Marciniak, Adam Mickiewicz University, Prof. Aygül Süel, Ankara University and Prof. Andreas Schachner, German Archaeological Institute, for kindly hosting us and guiding us to the excavations of Aşıklı Höyük, Çatalhöyük, Şapinuva and Hattusha and Yazılıkaya.

The excursions for ICAZ 2018 were organized voluntary by Prof. Aykut Misirligil, retired Professor of Ankara University.
Special thanks are also due to Gamze Durdu, Gonca Özger and Burak Hüseyin Soy who spent many hours helping during the last few months of preparations. In addition, Onur Alp Uluçay offered his graphic design skills for all printed material and items in the conference pack.

The book of Abstracts and Program were prepared by Evangelia Pişkin, Ezgi Sevimli, Gonca Özger and Gamze Durdu. The book covers were designed by İdil Ayçe Aba and İrem Dilek. The photograph on the cover pages was taken by Safoora Kamjan on a group of bones from Şapinuva and the one on inside pages by Mustafa Tatbul on materials from Komana excavation. The Conference management system was created and run by Arkeolab Consulting.

Many thanks to all those who contributed.

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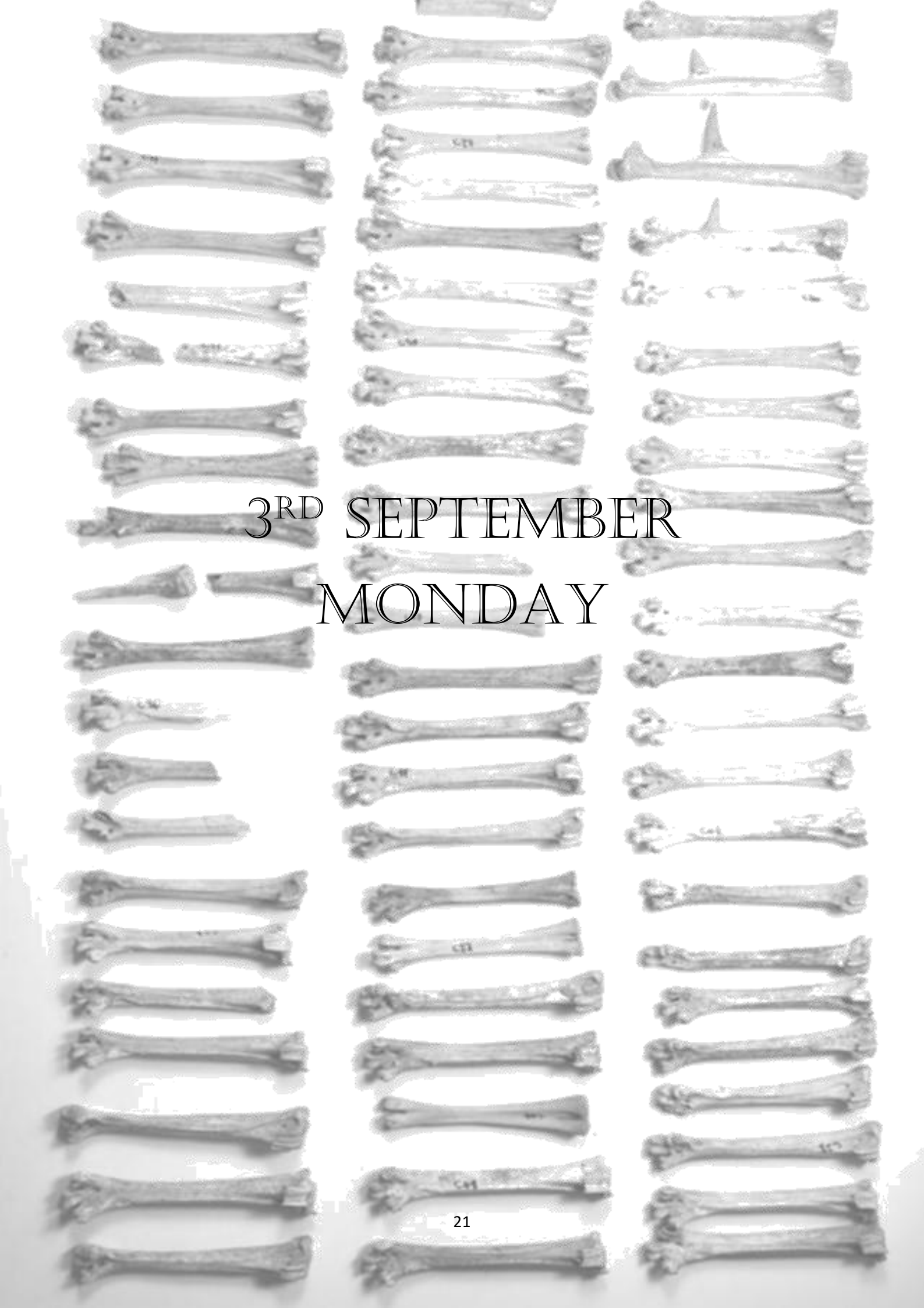

3rd September

Monday

Session Title:

Raw Material Choice and Ornaments: Aesthetics, Availability, Social Value and Manufacturing Considerations

Session abstract:

Ornament studies have only recently moved beyond the decorative aesthetic towards an understanding of how ornaments and their display are part of the complex way human beings communicate beliefs, social status and various identities both within their local group and the outside world. Ornaments can be worn directly by people or used to decorate animals, buildings, and settlements and even the surroundings of settlements.

By raw materials we generally refer to various kinds of hard osseous materials such as bone, antler, tooth, ivories and eggshells. However, there were certainly other products from animals that were used for ornamentation that come from animals such as bone powder for coloring other objects, hides, sinew carving and sinew braiding. While these latter objects are rarely found because of preservation issues any examples would be welcomed.

Sometimes the choice of raw material is connected to the size, density and consistency. Raw materials from animals can also be alternatives to more popular or typical raw materials. Other raw materials get their value from their exotic nature and rarity. Certain raw materials are chosen specifically because shared beliefs exist about the species and/or skeletal element they are manufactured from. Ornaments from carefully chosen raw materials can be connected to ritual, medicinal or apotropaic qualities. Finally, choice of individual raw materials can be influenced by multiple factors which change in importance within groups over time and place.

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ORAL PRESENTATIONS

Finding a common band-width: Causes of convergence and diversity in Paleolithic beads

Ornaments (a.k.a. beads) are the most common and ubiquitous art form of the Late Pleistocene. This fact suggests a common, fundamental function somewhat different to other kinds of Paleolithic art. While the capacity for artistic expression could be considerably older than the record of preserved (durable) art would suggest, beads signal a novel development in the efficiency and flexibility of visual communication technology. The UP was a period of considerable regional differentiation in material culture, yet there is remarkable consistency in the dominant shapes and sizes of Paleolithic beads over >25,000 years and across vast stretches of space, even though they were crafted from diverse materials and, in the case of mollusc shells, diverse taxonomic families. Cultural and linguistic continuity cannot explain the meta-pattern. The evidence indicates that widespread adoption of beads was not only about local and sub-regional communication of personal identity or group affinity, but also an expansion in the geographic scale of social networks. The obsession with rounded basket-shaped shells in particular related in part to their light weight, wearing ^{comfort}, and visual attractiveness.
The conformity of the beads grew spontaneously and in a self-organizing manner from individuals' interest in tapping into the network as a means for managing local risk.

Keywords: *Upper Paleolithic, beads, mollusc shells*

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Attachment technique of European elk (*Alces alces*) tooth pendants and kinships at the Late Mesolithic cemetery Yuzhniy Oleniy Ostrov (Lake Onega, Russia)

More than 4300 European elk (Alces alces) incisors, most of them fashioned to pendants, form the most common artefact type in the Late Mesolithic burial site Yuzhniy Oleniy Ostrov (YOO) northwestern Russia. Pendants derive from more than 70 mortuary features, unearthed during the archaeological excavations in 1936–1938. We analysed the manufacture technique of all elk tooth pendants from the collection MAE 5716 (Kunstkamera, St. Petersburg). A striking observation is that the attachment method for these pendants is similar in all burials. Without exception, the roots of elk incisors were worked by carving one or several grooves around the root tip to fasten the pendant with a thread. The uniformity of the chosen species, tooth type and technique indicates that strict norms prevailed in the industry of pendants at YOO.

Despite the overall similarity, our study shows some differences between burials, namely the number, location and depth of the grooves. A groove can cut the whole or part of the circumference, or several distinct grooves mark the opposite sides of the root. Sometimes the grooves are deep and carefully made, sometimes they are weak and hastily made. In most graves, one type of grooves dominates. We interpret this inter-burial variation as personal choices, taste of practicality and the variety of kins or families represented in the cemetery. The controlled variability in the technology suggests that the pendants, their details and ways of using were an expression of identity and origin of the buried person, either in individual, family or band level.

Keywords: *Late Mesolithic, elk tooth pendants, Yuzhniy Oleniy Ostrov, Northwest Russia*

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Zooarcheological contributions to the study of the Çatalhöyük figurines: Choice and modification of horse phalanges

Çatalhöyük is a Neolithic site (7100–5900 cal BC) located in Central Anatolia, Turkey. The site is well known for its large size (13 ha), complex nature, and animal symbolism, as seen in the reliefs of animal parts, paintings, and various configurations of animal parts in relation to the architecture. Recently conducted zooarcheological research has, for the first time at Çatalhöyük, revealed the presence of a horse phalanx that possesses incision marks shaped to resemble eyes. This find is associated with the opening of the last excavation area in Çatalhöyük, the GDN Area. We believe that this artifact has profound significance for our understanding not only of animal use and technological processes, but also of the figurine as an object. This will be elaborated in this presentation. The choice of horse phalanges as a raw material will also be discussed using evidence of other modified horse phalanges from the site and their contextual setting. Since similar artifacts are known from other Near East sites of various chronologies, this will serve as a platform for the general discussion of these so-called 'idols'. Interpretations will be provided of the choice of this kind of raw material in these artifact types.

Keywords: *Bone figurine, horse, Late Neolithic, Çatalhöyük, Turkey*

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Call of the wild? Animal teeth as ornaments in Neolithic Anatolia

Animal teeth in personal ornamentation are some of the earliest evidence we have for material culture: these long-lived practices are important evidence of hunter-gatherer human-animal relationships. With the introduction of new materials and technologies in the Epipalaeolithic and Neolithic periods, the role of existing ornamentation practices underwent considerable change, yet animal teeth remained a consistent, if less frequent, element of the repertoire.

We ask what the continued, albeit diminished, use of animal teeth means in relation to the individual meanings of beads and pendants: does the use of teeth change with the advent of agriculture and settled life? Is there continuation or departure in symbolism that transcends change processes? This paper will examine the personal ornament evidence from Neolithic period excavations in Turkey to consider how the diachronic use of animal teeth as ornaments may have a role in examining changing human-animal-landscape relationships.

Keywords: *Neolithic Anatolia, animal teeth, beads, pendants*

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The odd bone out? Exploring the zigzag motif on bone tools from prehistoric western Anatolia and beyond

The presence of ornamented bone tools has an extensive history, stretching back tens of thousands of years. One of the most common replicated motifs in prehistory is that of the zigzag, a line with abrupt alternate right and left turns. This motif has recently been found on a number of bone tools from a Neolithic (6000 BCE) context at Uğurlu on the island of Gökçeada. Due to the additional steps taken to create this object it is assumed to have had a higher level of significance at the site. But, should this assumption be revised when examining raw material choice? This paper will assess the zigzag design in relation to bone tool working, with a particular emphasis on raw material. Analysis will be centred on the examples found at sites in western Anatolia. A comparative analysis with worked bone objects in the surrounding regions will also be conducted, focusing on the prehistoric period, including both Paleolithic and Neolithic levels. Additional raw material examples, including ceramics, wood, and cave paintings, will also be examined to highlight the ubiquity of this motif and to examine the role of

this pattern during prehistory. Conclusions will highlight the importance of investigating ornamentation within a worked bone assemblage and underscore the value of raw material use.

Keywords: *Neolithic, Anatolia, zigzag decoration*

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Prof. Dr. Burçin Erdoğu, Trakya University.

The question of the social relevance of Bell Beaker beads and buttons in Central Iberia

The aim of this presentation is to highlight the difficulty of identifying the raw materials of some ornaments from various Bell Beaker tombs in Madrid region. These ornaments were traditionally identified as being made of bone or exceptionally elaborated from African elephant ivory. Our research during the last decade testifies the amazing variety of resources employed in the elaboration of these ornamental pieces. Several combined analyses performed, came to results of great interest, not only for being able to identify foreign raw materials, but also fossil resources. The possibility that these pieces were made of fossil has always been discarded until now. Materials such as antler, mammal bone, and tusks of the forest elephant could have been locally available. Others necessarily came from long distance exchanges such as ivory of African steppe elephant and sperm whale tooth. The study of the different origins of the raw materials, the typologies and their funerary contexts, allows us to discuss the social value of these, often undervalued, pieces in relation to other characteristic grave goods as the Bell Beaker pottery, copper weapons, gold ornaments and flint artifacts. The intentional selection of these varied and often exotically raw materials gives us a new perspective of the social and symbolic value of these items that are granted only to certain individuals with exclusive funerary rituals.

Keywords: *Bell Beaker tombs, Madrid region, exotic raw materials*

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Raw material choices for ornaments in the Bronze Age Maros culture

The Maros (Moriš) culture of the Early Bronze Age was widespread in the southern Carpathian basin, around the confluence of Tisza (Tisa) and Maros (Moriš) rivers. In Serbian part of Banat, two large cemeteries were excavated in the 20th century: Ostojicevo and Mokrin. The burials were usually equipped with diverse grave goods: ceramic vessels, metal jewellery, metal weapons, and also relatively large amount of ornaments made from osseous raw materials were discovered.

Osseous raw materials were very diverse; they included bones, antler segments, teeth and mollusc shells from several species, possibly both fossil and fresh. Strict raw material choices for specific artefact types can be noted: small ruminant metapodial bones for beads, while perforated teeth were almost exclusively dog canines, with rare occurrences of red deer canines or horse or cattle teeth. Despite common presumption that the metal ornaments had greater value because of the raw material, and that the osseous ornaments were simply “cheap substitutes”, these two necropoles prove otherwise. These ornaments display long use, sometimes were even repaired, suggesting they were valued and perhaps even had some symbolic significance. Use of mollusc shells in different stages of preservation, some even heavily damaged and fragmented, as well as presence of copies of pendants in white stones, suggest that the osseous ornaments had the value of their own right, related to their physical properties, in particular shiny, white colour, and/or for the attributes ascribed to the animals from which they derived.

Keywords: *Maros culture, Bronze Age, osseous raw materials, ornaments*

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Crafts combined: An archaeometric study on Early Bronze Age ornamented pins from Poland

In the archaeological context raw materials are often intertwined – the most obvious example being an adornment made of strings of beads of different provenance. In this presentation we intend to focus on how different prehistoric crafts were involved in the manufacture of Early Bronze Age 'functional' ornaments – clothing pins. We studied two bone artefacts that have geometric patterns cut into the surface and filled in with a dark grainy substance. One of the pins has also largely homogeneous green colouring extending over the noneroded parts of the surface. Main objectives of the study were thus: (1) identification of the substance in the cut-marks; (2) determination whether the green staining is a result of intentional colouring or of taphonomic processes. Imaging and spectroscopic techniques were employed to analyse the objects. We established that a paste made of siliceous sand and coloured by a carbon-based pigment had been used to fill in the cut ornament. Copper was detected on the surface of the green pin however intentionality of its use is a question of interpretation. From the evidence it can be inferred that the craftsperson was skilled not only in bone working but also faience making, pigment preparation and possibly even metal working. This supports the hypothesis about a technological continuum within the Early Bronze Age Epi-Corded Ware communities of Central and Eastern Europe.

Keywords: *Early Bronze Age, pins, faience decoration, copper*

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Off the Rack: Elaborated antler production in Middle Bronze Age Hungary

One marker of the Middle Bronze Age in the Carpathian Basin and northern Italy is the trend toward the bi-polar treatment of bone and antler in the production of tools for daily life and ritual as well as ornaments. On the one hand, bone, while still an important raw material for making tools, is used in a much more casual manner to produce relatively simple objects. On the other hand, antler production develops one branch of manufacturing that is increasingly more elaborated, decorative and complex. There is a question whether semi-specialists were involved in the creation of these pieces, some of which could be beautifully worked using metal tools which do not appear to have been available to everyone in this period. The objects created range from decorated burr and beam antler tools, horse harness ornaments to mysterious but elegant pointed objects. New forms of attachment come into play as well as use of antler inlay to complete tops for containers and grips of various kinds can also be found. A similar trend can be seen with the Middle Bronze Age tools documented by Noelle Provenzano on Terre Mare assemblages in northern Italy. Clearly red deer antler, always a special raw material, takes on new value in this period. By the Late Bronze Age, new ornamental forms in metal become ever more accessible to the population and the very elaborated objects of the Middle Bronze Age decrease in number. This paper will explore the variety of worked antler forms – unlike the bone objects often carved with metal tools – of the period in this region and suggest explanations for this surge in the popularity of antler.

Keywords: *Hungary, Middle Bronze Age, semi-specialists, red deer antler, decoration, tools, ornaments, composite objects*

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Mass bone-working industry during the Western Zhou dynasty (1046-771BC)

During the Late Bronze Age, craft production in China underwent a series of significant changes, involving not only technical innovations, but also a thorough transformation of production organization management, increasing cross-sectoral cooperation, and mass craft production in restructured urban environments. This study will discuss these fundamental issues from the perspective of the new fieldwork at a bone-working workshop at the Zhouyuan site, a royal capital during the Western Zhou dynasty (ca. 1046-771 BC). The tons of archaeological remains for making hairpins unearthed from this site provided a distinctive window for us to get deep into each aspect in the basic operation of mass bone-working industry at the time, including raw material procurement, manufacturing techniques, and the mechanism for distributing finished products. Moreover, from the macro-economic perspective, the production of cheap bone hairpins for the commoners in the dynastic capital had functioned as one of the essential sectors in the network of animal economy in an urbanized context. On the one hand, the technical choices in bone-working production were restrained by other types of ways for exploiting animal resources. On the other hand, certain technical or organizational requirements by bone-working activities also reshaped other related upstream and downstream handicraft industries in the same city.

Keywords: *Western Zhou, China, bone pins, organization of*

production Hao Zhao, Zhengzhou University. donitzhao@126.com

Bone tools from Chengsijiazi (Liao and Jin dynasties), China

The site of Chengsijiazi is located in Baicheng City of Jinlin Province, China. It is an ancient city of the Liao (AD 907-1125) and Jin (AD 1115-1234) dynasties. The Jilin Provincial Institute of Cultural Relics and Archaeology conducted systematic excavations at the site from 2013 to 2015, covering an area of about 4100 m2, unearthing a number of artifacts.

A total of 1627 fragments of faunal remains were recovered, of which 1260 specimens were identified as belong to cattle, equid, camel, and dog. The assemblage is dominated by the remains of cattle and equid, which account for approximately 54% of the identified specimens. Most of the bones are tools or remnants of tool production. The raw materials and semi-finished products are primarily from long bones of large mammals. In most cases, the two ends of long bones were sawed off. The shafts left were then made into bone tools.

According to these faunal remains and related contextual evidence, we conclude that there might have been a workshop for bone tool manufacture. A nearly complete chaine operatoire can be reconstructed based on the raw material and semi-finished bone artifacts, shedding light on the daily life of the Liao and Jin periods.

Keywords: *Chengsijiazi site, bone tools, Liao and Jin dynasties, faunal remains*

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The mystery of the boar tusks

In 2015 a mithraeum has been found in the outskirts of the Roman vicus of Kempraten at lake Zurich. The largest group of findings by far are animal bones, mostly from chicken and pig as might be expected. Most pigs were killed very young. Furthermore 67 canines of adult boars have been found which have nothing to do with these piglet bones. There are some difficulties to make the difference between wild and domestic boar, but at least it can be said that there are tusks of both. Quite a lot of these tusks have zones of brown discoloration, mostly at the tooth root and/or in the middle of the tooth. We are wondering if these discolorations happened by some kind of fitting. Most of these

objects have been found in the middle and the southern aisle of the mithraeum. Perhaps the objects have been fixed on the walls. But for what reason?

Keywords: *Roman period, vicus, Kempraten, Switzerland,, boars' tusks, mithraeum*

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Perforated bone spoons: Exploring a unique Romano-British artefact

Perforated bone 'spoons' are an artefact type that appears to be unique to an area of Roman Britain, centred in the modern county of North Yorkshire. There has been speculation about their purpose for over a century, and includes their use in textile manufacturing and as personal ornaments. In pulling together the records of all known examples, our collaborative project has shed new light on these enigmatic objects and the material from which they were made, using the latest techniques of non-destructive investigation, including visual identification, surface texture analysis and proteomics.

Keywords: *Bone, artefact, Roman, identification, manufacture*

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Music in bone: Middle Horizon Period (AD700 to 1050) whistles and flutes from La Real, Arequipa, Peru

Raw material choice is a key factor in producing musical instruments. The density and shape of bone will impact the sounds created and therefore the careful selection and manufacture of instruments provide an important case study to understand production practices and stylistic preferences related to bone material. A collection of musical instruments was recovered from La Real (AD700-1050), Arequipa, Peru and these artifacts were exclusively found in the early Middle Horizon (AD700-850) of the site. There are both whistles (n=36) and flutes (n=6) made from camelid and condor bone. The Middle Horizon is known for the start of longer-distance interactions and the beginning of conflict and inter-personal violence. The site of La Real is a key mortuary context found in the Majes Valley where 145 individuals were interred with prestigious artifacts of human trophy heads, parrots, dogs, textiles and obsidian. The recovery of musical instruments is a possible connection to coastal influence from Nasca polities, which have vivid depictions of musical processions and a large corpus of musical instruments of ceramic, wood and cane. This paper will showcase analysis that has been conducted on the bone instruments from La Real, in which microscopic evidence shows that great effort was dedicated to finishing these mortuary offerings and that a standardized design may have existed for the way that these instruments were produced. Ethnographic evidence attests to the importance of camelid sounds in various parts of the year for herding communities. This paper will argue that the active use of camelid bone for musical instruments reinforces the significance of these animals for daily, annual and ritual practices.

Keywords: *Music, camelids, chaine opératoire*

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How many deer does it take to decorate a floor? Decorative use of animal bones in an 18th c. bathhouse floor at Wrest Park, Bedfordshire, UK

Animal bones and teeth are hard-wearing and their shapes create eye-catching designs. They were commonly used as building materials and decorative elements in post-medieval structures in England,

including in urban ‘knucklebone floors’ as well as in rural garden buildings and features. In addition to structural, architectural and design information, bones used in buildings offer huge zooarchaeological research potential as they are often well-dated and comprise 100s or 1000s of bones deriving from only a few species and skeletal element types. They may represent however a highly selective dataset. A restoration project at Wrest Park, Bedfordshire provided the opportunity to record and analyse in detail the pebble and bone floor of an 18th c bathhouse. The bones comprise exclusively red and fallow deer metacarpals and metatarsals from a minimum of 100 animals. The methods of recording and analysis, including distinction of red and fallow deer metapodials, are described here. The data are compared to the written archive for the supply of materials and estate management at Wrest Park, and allow a consideration of the impact of selective processes on interpretation of animals and landscapes, and wider themes of bone use and trade.

Keywords: *Post-medieval Britain, decorated floors, red deer, fallow deer, metapodia*

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POSTER PRESENTATION

A group of bone ornaments from Prehistoric Samsun Region, Black Sea, Turkey

The first excavations in the Samsun area, Southern Black Sea, Turkey began in 1940-1941 at the sits of Dundartepe, Tekeköy and Kaledoruğu. The excavations lasted only 2 seasons. Despite the increase of research since 1970 our knowledge of the region, especially in prehistoric period, is still insufficient. As a result, all the information that can be derived from these prehistoric excavations is important.

There are a total of 80 worked bone objects found in these excavations and kept at Samsun Archaeology and Ethnography Museum. These bone artifacts are different in their functionality. Amongst 80 bones used for tools there is a limited number of finds that can be classified as ornaments. Specifically, there are three pins, with decorated heads which may have been used as fibulae or hair ornaments. One of them stands out of the rest for being totally burnt black. It is suggested that this pin is purposefully burnt to give color to it. Further than these there is a bone tube believed to have been used as ornament and another two objects that seem not to have a utilitarian function. . One is a possible pin and another one is a fish vertebra which is perforated in the middle. These finds are discussed in this poster and compared with parallels from other sites in Anatolia.

Keywords: *Black Sea, Prehistoric, ornaments, pins, fish vertebra*

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Session Title:

Identifying and interpreting food taboos: A zooarchaeological approach

Session abstract:

This session aims to highlight the important role of zooarchaeology in assessing the presence of dietary taboos in faunal assemblages, and interpreting their socio-cultural, religious, and economic significance. The session is open to all zooarchaeological studies dealing with dietary taboos in different geographical areas and periods, from prehistory to contemporary times.

In archaeology, the characterisation of the socio-cultural background of past communities is often based on the study of buildings, funerary practices, and material culture. Despite the considerable amount of animal bones and teeth recovered from archaeological sites, this valuable material is less often used to determine identities in past societies. Nevertheless, animal remains are often associated with food consumption, an important cultural identifier. When humans recurrently eat a specific food, this becomes part of their cultural roots, whatever the origin of such consumption practices. Equally, the prohibition of some food products can be associated with specific cultural backgrounds. In the literature, the avoidance of eating certain foods (beef, pork, fish, etc.) is commonly defined as 'food taboo'. This definition, however, does not only refer to the avoidance of consuming specific animal species, but also to the rules on how animal products were processed. Indeed, in some cultures (e.g. Jewish or Muslim) there are also well-defined butchery rules that make certain animals, or parts of thereof, allowed and others prohibited for consumption. This set of butchery practices may leave visible traces on the bones, thus allowing the identification of specific cultural practices.

For all these reasons, the zooarchaeological study of animal remains has great potentials in detecting the presence of dietary taboos and in highlighting their wide implications within past communities.

This session particularly welcomes papers presenting zooarchaeological case-studies, regional syntheses, and methodological approaches to the study of food taboos and/or particular butchery patterns linked to specific cultural practices.

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Keynote speech:

Food as a cultural marker in archaeology

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ORAL PRESENTATIONS

Was pork off the menu? Meat consumption in Sicily in Muslim times (9th-11th century AD)

In the 9th century AD, Sicily became a frontier of the Muslim world. The Arabs introduced several socio-cultural and economic changes, which also impacted on the dietary habits of the local Christian population. Food is often used as a means of ethnic differentiation between different religious communities, and faunal remains represent an invaluable tool to detect such culturally-driven food preferences. In the case of Muslim cultures, faunal assemblages are particularly useful to detect permanent dietary taboos. This study investigates meat consumption in Muslim Sicily, with a special focus on the introduction and spread of Muslim food taboos, most famously that on pork. Faunal assemblages from urban and rural sites were analysed. Zooarchaeological results show that pork was almost banned from urban centres, where mutton was by far the preferred meat. Intriguing results emerged from the Sicilian countryside; here, pigs were raised and consumed during the Muslim period, in line with the previous Byzantine and the following Norman phases. As a result, it seems that the well-known Muslim aversion to pork consumption was not applied at the same scale in the entire island, suggesting a less intensive cultural pressure in rural areas. The presentation highlights the key role of zooarchaeology in detecting food taboos, and interpreting them within the wider archaeological and historical context.

Keywords: *zooarchaeology, food taboos, Muslims, pork, animal husbandry*

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Pig tales: Swine consumption in Medieval Iberia

The development of zooarchaeological studies of medieval Iberia during the last decade has brought to light a remarkable faunal record, which in turn, has contributed to long-standing debates regarding social identity and complexity in this region. Recent works have discussed the importance of pork consumption as an archaeological marker for socio-economic status in medieval Iberia, but the possibility of using suid remains for identifying different ethno-religious groups has not been fully examined yet. This is somewhat surprising, as for most of the Middle Ages (broadly, between the 6th and the 15th centuries), the Iberian Peninsula was a cultural melting pot in which three main faiths intermingled (Christianity, Islam and Judaism), and arguably swine consumption was one of the main factors of distinction between them. In this paper, a comprehensive overview of available zooarchaeological evidence of suid remains (Sus sp.) will be carried out for Iberia through medieval times, comparing the northern Peninsula -where pork was a common dietary item-, with areas under Islamic rule -where pig consumption was avoided-, also pointing out the scarce, albeit important, visibility of Jewish communities, for which pig is also an important food taboo. The results show clear distinctive patterns of pig consumption for Christian communities, and pig avoidance for Muslim and Jewish communities. However, in Islamic al-Andalus, the taboo over pig does not seem to be absolute, with a small proportion of suid remains in the majority of sites. These suid remains will be discussed, in light of new biometric evidence suggesting that these remains might have been of wild boar, rather than pig.

Keywords: *Zooarchaeology, food taboos, Muslims, pork, animal husbandry*

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Defining the meat pattern consumption in the Nasrid period (13th - 15th centuries): Initial conclusions

The study of the food in the Nasrid period in Iberia (13th – 15th centuries) has been solely based, until recently, in documentary sources and analogies with other Muslim societies. This has created a partial knowledge of the dietary practices of this Muslim community. In the past few years, the number of

zooarchaeological analyses about the last Andalusí society have increased, allowing to draw a preliminary characterisation of meat consumption in this period.

The volume of data available enables us to compare between the information present in written sources and zooarchaeological data, and thus to evaluate the degree of observance of the religious food taboos and the relevance of certain cultural aspects. To this purpose, the conclusions from the studies of the documentary sources have been revised (Kitab al-Agdiya, hisba recommendations), and they have been compared to the information provided by zooarchaeological analyses. The zooarchaeological data originate from sites located in the Nasrid geographical frame, in the Southeast of the Iberian Peninsula: Macael Viejo (Almería), the castles of Luque (Córdoba) and Íllora (Granada), and the town of Granada.

The information obtained has allowed us to evaluate the degree of fulfilment of certain religious precepts (like the ban on pork consumption), to qualify cultural options (like the preference for lamb consumption compared to cattle meat), and to define distinguishing elements of the Nasrid society based on zooarchaeological data. The characteristics of the information from each record (zooarchaeology and written sources) will also be discussed.

Zooarchaeology, food taboos, Nasrid period, pork, animal husbandry

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"I could eat a horse!" – on the taboo of horse meat consumption

Horses have accompanied humans throughout history, slowly evolving from a mere source of food into invaluable companions. They offer a level of speed and mobility which was unrivalled for thousands of years, enabling mankind to colonise continents, spread knowledge and conquer entire empires. Their role in history is undoubted; however, the consumption of horse meat in past societies represents a major source of debate. A taboo in the Roman world, horse meat was considered a delicacy in the Germanic countries until the prohibition by Pope Gregory III. in 732. So when the Anglo-Saxons settled in Britain in the 5th century, they brought the tradition of hippophagy with them. However, horse remains are scarce in the archaeological record and evidence for the dismember-ment of carcasses in preparation for consumption is relatively rare. While in Roman assemblages butchered horse remains are the exception, horse meat seems to have played a regular, albeit minor, part in the Anglo-Saxon diet. Ageing data show that most horses would have lived far beyond skeletal maturity, suggesting that they were kept primarily for riding, transport and as draught animals. Since the quality of horse meat does not deteriorate with age, it would be plausible to assume that horses were only culled and eaten or perhaps fed to the dogs after they had concluded their working life.

Keywords: *Equids, food taboos, Roman, Anglo-Saxon, Britain* Helene

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Following the Rule? Freshwater fish consumption and dietary restrictions in monastic diet in Medieval England

Around AD 530, St. Benedict created a Rule for the members of the cloister regarding diet, lifestyle and how to fulfil a life according to the moral principles of poverty and restraint. According to the Rule, food and drinks had to be consumed in moderation during scheduled meals, with more restrictions for the fast days. The consumption of meat was forbidden in the monasteries, with some exceptions, and fish, in contrast, was widely consumed. Both historical and archaeological evidence seem to testify how, over time, the Rule was far from being strictly followed, and could be interpreted in a variety of different ways. As a result of this process, by the later Middle Ages, monastic diet was comparable to a form of aristocratic diet, both in terms of quantity and variety of food consumed. This paper compares the diet of religious and upper class sites after the reinforcement of the Benedictine Rule of the 10th c. AD, through the analysis of fish remains. A special attention will be dedicated to

the frequencies and species distribution of freshwater fish, which was considered a luxury food and regarded as fundamental part of the aristocratic diet from the 11th to the 15th c. AD. Preliminary results suggest that fish remains do not always reflect the status of monastic sites, as in the case of Eynsham Abbey. These data will be further compared with the remains from aristocratic sites, such as Stafford Castle, where, conversely, species frequencies clearly reflect the high status of the castle.

Keywords: *Zooarchaeology, England, Middle Ages, fish remains, religious and high-status sites*

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Reassessing zooarchaeology's approach to the biblical foodways and taboos

Identifying food prohibitions and foodways that are described in the Hebrew Bible relies primarily on an amalgamation of zooarchaeological methodologies and Biblical scholarship. The general discussion regarding the identification of the Biblical dietary laws in archaeological contexts has primarily fixated on the pig taboo. However, additional Biblical food laws and taboos can and should be explored to fully understand the role of animals in the Southern Levant during the periods of Biblical authorship and redaction (mid-late first millennium BCE). Adapting the discussion of Biblical animal use to focus on the butchering patterns, including the separation of the priestly tithes, and other tabooed species (i.e., catfish) may shed light on the development and reflection of these laws into daily life. A matter of contention in this discussion is that many of these laws are comprised of multiple verses from different books, to what degree was our understanding of these laws influenced by the later Mishnaic and Talmudic writings, and parts of these foodways also may date to different historical periods. Current methodologies are divisive and this paper aims to mediate the current debates within scholarship and propose parameters for future research.

Keywords: *Foodways, Southern Levant, dietary laws*

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To eat or not to eat, a mollusc food taboo in Phoenicia?

Kosher laws prohibit fish without fins and scales. The origins of Kosher laws date back to the Iron Age and may explain the scarcity of evidence for the use of shellfish as a food resource in the Southern Levant. Interestingly, shellfish does not feature prominently in present-day Middle and Northern Levantine cuisines either. We ask whether the Phoenicians, an Iron Age people of the Levantine coast, also applied similar laws. The scarcity of evidence for the use of shellfish as food in the Iron Age archaeological deposits on the Lebanese coast inspired our query. In this study, we tackle the possibility of a shellfish taboo in Phoenician culture by analysing a zooarchaeological assemblage of molluscs, Crustaceans, and echinoderms from the Iron Age phases of Tell el-Burak. Tell el-Burak is a multi-period settlement mound located right on the Levantine coast. The zooarchaeological assemblage, found amidst ritual and domestic architectural remains, consist of numerous 'shellfish' remains as well as vertebrate bones and teeth. Our study focuses on the taphonomy of the remains of shellfish, as well as taxonomic identification of the specimens. We tackle the environmental, social and religious factors to explain our results. This study is unique in terms of its analytical and theoretical approach and in terms of the context of its case-study. Most of what we know archaeologically about Phoenicians comes from investigations in their western Mediterranean colonies, and most zooarchaeological work reporting (if at all) invertebrate remains from the Levantine Iron Age consists solely of taxonomic lists.

Keywords: *Phoenicia, Lebanon, Molluscs, food taboo, Tell Burak*

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Keeping Kosher at the medieval settlement of Mota del Castrillo, Castrojeriz (Burgos, Spain)

Historical documents point to the year of 1035 as the origin of Mota del Castrillo's settlement, when the Jewish community was removed from the neighbouring village of Castrojeriz (Burgos, Spain). According to the same sources, this population group stayed there until they were allowed to come back to the original aljama in 1311. From then onwards the quick decline of the Mota site began. Such precise dates provide an excellent chronological framework for the abundant faunal remains recovered. Preliminary analysis of the 2016 and 2017 archaeological campaigns demonstrate the dominance of livestock and domestic fowl, with few wild species represented. Anatomical profiles and standardized butchery marks reflect carcass processing techniques and meat consumption habits probably linked to the Kashrut. In addition, the excellent preservation of most of the samples points to the quick disposal of butchery and food debris, thus showing this rural community had an organized system of rubbish management. Finally, the biometrical data taken from complete pelves and metapodials allowed us to estimate the sex profiles of the main taxa, which together with the aging data grant interesting information on the husbandry production strategies followed by this Jewish population.

Keywords: *Mota, medieval Jews, standardized butchery, dietary practices, metrical data* Marta

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Finding the displaced tendon: The search for traces of the Jewish butchery in zooarchaeology

The research addresses the problem of detecting in the zooarchaeological record traces of porging (*nikur*)– an exclusively Jewish butchery activity essential for producing kosher meat – and using it as an indicator of the presence of the Jewish communities in the past. The Jewish presence can be detected through several zooarchaeological indicators. These include the absence of bones of animals unclean in Judaism, predominately the pig; and, occasionally, the absence of the hindlimb bones caused by the restriction on the consumption of hindquarters which were notproperly porged. Both, however, are elusive and not always unambiguous and clear to detect. In this research, we are trying to recognise another indicator of the Jewish presence: the porging pattern. Animal hindlimbs are forbidden to be consumed, unless the 'displaced tendon' – or sciatic nerve – is removed during porging. To recognise the potential butchery pattern left on hindlimb bones after porging, we combined information from religious texts with an ethnozooarchaeological research, in which we analysed caprine bones from a traditional religious Jewish butchery in present-day Israel. The observations were used during the analysis of animal bones from sites connected to Jewish habitation from Roman Age Israel (Jerusalem: Kidron and Mt. Zion dump; and its agricultural hinterland: Shu'fat and Tell el-Ful) and medieval and post-medieval Poland and Bohemia (urban sites of Chełm, Lelów, Wrocław, and Prague). The similar pattern was detected on a substantial number of bones from all analysed Jewish sites in Central Europe; however, is yet to be clearly evidenced in Ancient Israel.

Keywords: *Ethnozooarchaeology, Jewish butchery, Roman Age, Middle Ages, post-medieval period*

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The foodways of Ashkenazi and Sephardi Jews in post-medieval Amsterdam

The Jewish diaspora of early modern Europe that coincided with the expansion of Amsterdam as an urban and commercial centre of Western Europe meant that many Jews settled in the former

Amsterdam neighbourhood of Vlooienburg. Two of Vlooienburg's house blocks were systematically excavated in the early 1980s, prior to the construction of a new City Hall and opera house. The numerous refuse pits that were encountered associated with former houses contained an extraordinary amount of refuse including food waste and animal remains. The remains from a selection of these refuse pits have now been studied in order to gain a better understanding of the foodways and identity of their consumers. Preliminary results indicate that a number of these pits provide a valuable insight into kosher practices amongst both the Ashkenazi and Sephardi Jews, who inhabited Vlooienburg between AD 1600-1800. This PhD project is funded by the Netherlands Organization for Scientific Research (NWO) as part of the Diaspora and Identity Project, a three-way public private partnership between the University of Amsterdam, the City of Amsterdam Office for Monuments and Archaeology, and the Jewish Historical Museum.

Keywords: *Zooarchaeology, Jewish, Amsterdam, post-medieval, food taboos* Jan

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No seafood and no beef: Food taboos in the Cyprus Neolithic

This presentation will highlight several marked originalities in the animal food in Cyprus from the Epipaleolithic to the Clacolithic. First is the presence of only one ungulate species in the diet during ca. two millennia, from 10.5 to 8.4 kyrs cal BC: a wild boar which had likely been introduced to Cyprus for re-stoking the island after the extinction of the large mammal endemic fauna. Although this originality is resulting from the insularity rather than from taboos, it is highly heuristic for the archaeological approach of food history. More surprising is the total absence of seafood in the littoral Cypro-PPNA site of Klimonas (ca. 8800 cal BC), and the scarcity and low taxonomic diversity of fish remains all along the occupation of the site of Shillourokambos (8400-7300 cal BC). Several hypotheses will be discussed. The decrease of the frequency of cattle remains during the Late Cypro-PPNB and the complete absence of any bone of this species from ca. 7000 to 2500 cal BC is another strangeness of the food history in Cyprus. It will be revisited at the light of the long history of food and food practices in the South-West Asia.

Keywords: *Zooarchaeology, Cyprus, Epipaleolithic, Clacolithic, seafood,*

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Archaeology of meat eating taboo in Japan: Revealing unwritten history

The effectiveness of zooarchaeology in revealing the actual food cultures considered taboo or those related to the lower class less likely to be recorded in documents will be discussed. There is a common notion that taboo on meat eating in Japan became widespread with the introduction of Buddhism. However, the mortality profile of horse and cattle dominated by young individuals in the classic period suggest slaughtering for meat even after the introduction of Buddhism. After the medieval period, taboo on meat eating among upper class begin to appear gradually in documents. This phenomenon is visible archaeologically as spatial segregation of processing sites which accompanied the fixation of the class involved in processing animals for hide. Hierarchy of taboo according to taxa also existed. Livestock was considered most disgusting, and remains of horse and cattle are rarely found from castle sites. Even from a meat seller site, only wild animals were found. In western Japan, the existence of outcaste class involved in systematic processing of cattle and horse (most likely accompanying meat consumption) has been discussed in depth from historical and archaeological evidence. In contrast, such class or system seem to be less developed in eastern Japan. Mass horse grave sites consisting of old individuals with bones intact in rural village sites supports this view. The reality of meat eating habit was much more complex than the common view and differed according to time period, class, region, or taxa.

Keywords: *Japan, horse, cattle, meat, hide*

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Ethnoarchaeological investigation of rational food taboo decisions among Savanna Pumé hunter-gatherers of Venezuela

Food taboos have primarily been treated anthropologically as elective cultural choices that are generally free of any empirical nutritional, epidemiological, or resource management bases. There are suggestions that some such rational behaviors may structure a few food taboos, but this view appears to remain a minority opinion. Ethnoarchaeological observations of subsistence returns, seasonal food choices, and emic identifications of animal sources considered to be inedible among a group of savanna hunter-gatherers in Venezuela underscore regularities seen among other foraging groups. The example provided by Savanna Pumé foragers is particularly relevant as they live in an environment with a depauperate terrestrial fauna, relatively low food returns, pronounced seasonality, and significant epidemiological challenges. This presentation outlines what appear to be rational decisions about the exclusion of particular classes of animals from the Pumé hunter-gatherer diet in the low-food density and diversity Venezuelan llanos. Additional comparisons to both quantified and qualitative data in the ethnographic literature support inferences that many food taboos are based on sound indigenous nutritional science. This includes the exclusion of high trophic level carnivores, scavengers, the restriction of some body parts from consumption by children and reproductively active women. Counter-examples from the hunter-gatherer ethnographic literature appear to be almost exclusively identified among highly land-stressed or refugee foraging populations.

Keywords: *Ethnoarchaeology, food taboos, Savanna Pumé foragers, Venezuela*

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Fish consumption at Hellenistic Jebel Khalid, Syria

The faunal analysis of fish consumption patterns at Hellenistic Jebel Khalid in Syria examined fish remains from widely separate and apparently functionally distinguished areas of the site, specifically the Acropolis, Housing Insula and Commercial areas.

The analysis suggested highly patterned distributions of fish remains, with fish characterising Acropolis assemblages, while being virtually absent from other areas of the site. The local worship of the Syrian goddess Atagatis may have involved the veneration (and offerings) of fish in Acropolis ritual contexts, while the absence of fish remains from other areas of the site suggests prohibition of the consumption of fish within the general community.

This paper will present the faunal assemblages from Jebel Khalid, focussing on the fish remains, and explore various scenarios to account for the highly patterned distributions across the variety of functional zones excavated.

The site of Jebel Khalid is situated on the Euphrates river, immediately south of the Tishreen Dam and at the margins of rain-fed agriculture on the Syrian steppe. With no evidence of built occupation prior to the Hellenistic period (c. 300 BCE) and the virtual abandonment in Early Roman times (c. 70 BCE), its Hellenistic character is uniquely preserved.

The population of Jebel Khalid, a fortified military garrison, is assumed to have comprised the local indigenous population, polyethnic mercenary soldiers and settlers of Graeco- Macedonian backgrounds. The extensive cultural assemblages from the site suggests a cultural identity made up of a fusion of Greek and indigenous Iron Age traditions.

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POSTER PRESENTATIONS

Dietary taboos and totemic systems of the Akans of Ghana: Indirect cultural practices for conserving fauna species

Dietary taboos and totemic systems have been part of the rich cultural heritage of the Akans for centuries since the 1600s. These important cultural practices established by the Asante old sages backed by robust traditional religious beliefs have been able to restrain the mass harvesting of mostly endangered fauna species while conserving the critically threatened fauna species. A qualitative research with phenomenology and case study as the main research methods was carried out to investigate the socio-cultural, religious and economic and zooarchaelogical significance of the dietary taboos and totemic systems in understanding the historical developments of the local communities. The study was conducted within four local communities in Ghana to ascertain how traditionally accepted and enforced prohibitions regulate the use of fauna species. Personal Interviews, Focus-Group Discussions and Observations were the main data collection instruments used in soliciting for data from eighty-five (85) purposively sampled respondents consisting of traditional authorities, traditional priests/priestesses, elderly residents in the study areas, and the park officers working in the Wildlife Division of the Forestry Commission of Ghana. The gathered data was analyzed using the Interpretative Phenomenological Analysis. The study contends that dietary taboos and totemic systems of local communities have played significant roles that have bolstered conservation efforts for the fauna diversities in Ghana. The study recommends that governments must legalize and strengthen the powers of traditional authorities in local communities in enforcing these traditional instruments as part of maintaining their cultural heritage that inures to the conservation of fauna diversities.

Keywords: *Dietary taboos, taboo systems, fauna species, zooarchaelogy, culture*

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Session title:

Exploitation of animal resources in the prehistory of the South-East Europe

Session abstract:

Zooarchaeological studies were not equally well represented in all regions and within particular archaeological traditions. In the South-East Europe, zooarchaeology was long neglected throughout the 20th century, with few notable exceptions. However, especially in past two decades, this situation changed considerably. New advances in archaeological method and theory brought in the increased interest in zooarchaeology; new courses are introduced in faculty programmes and young scholars started their academic career. Within past two decades, beside systematic excavations of different scale, also numerous large-scale rescue excavations were carried out, providing large amounts of archaeological material, which in turn produced new data and new, interesting results, Furthermore, several multi- and interdisciplinary scientific archaeological projects were conducted, both within national boundaries and international ones.

The aim of this session is to present the results of the recent studies and diverse syntheses, and to offer a new framework for better understanding of the exploitation of animal resources in different periods of prehistory. Geographically, we would like to include the South-East Europe and adjacent areas. Thematically, we would like to invite all types of studies, from more traditional studies, focused on taxonomy and taphonomy, to multi- and interdisciplinary scientific analyses, specific case studies or general syntheses, as well as papers focused on methodological and theoretical problems.

The intention of session organizers is to publish the papers, in an edited volume or as a special issue in a peer-reviewed journal.

Organisers:

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ORAL PRESENTATIONS

Late Neanderthal subsistence in Dalmatia: New data from Mujina Cave (Croatia)

Mujina Cave is a small cave located on a mountain slope above Kaštela, west of Split on the eastern Adriatic's Dalmatian coast. The site yielded rich vertebrate remains associated with a Late Mousterian lithic assemblage dated to c. 40-45 kyr (MIS 3; Rink et al. 2002). This study focuses on the larger vertebrate remains from the middle and lower stratigraphic contexts (E complex – Layers E1, E2A, E2B, E3A, E3B, and E3C) and compares them to the upper part of the sequence (Layers B, C, D1, and D2) analyzed in detail by Miracle (2005; Karavanic et al. 2008). Red and fallow deer are dominant throughout the E complex, although there are significant changes in their relative frequency that most likely correspond to changing palaeoecological conditions. The steppe rhinoceros (Stephanorhinus hemitoechus) is a significant addition to the species list. Detailed taphonomic analysis shows numerous traces of butchery, but also the evidence of the presence of non-hominin carnivores (e.g. cave bear, hyena, and wolf). The Mujina Cave faunal assemblage provides significant data for understanding Late Neandertal hunting, food processing and consumption practices, and their sensitivity to changing palaeological and cultural conditions.

Keywords: *Middle Palaeolithic, Neandertal, Croatia, hunting, cave, zooarchaeology*

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An inquiry into the "missing" Central Balkans Mesolithic: Faunal remains from Bukovac cave, Serbia

Apart from the well-known Mesolithic sites in the Danube Gorges, occupied more or less continuously between c. 9500-5500 cal BC, the evidence of human presence in the North-Central Balkans in the Early Holocene is virtually non-existent. This puzzling phenomenon has been associated with presumed low population densities, changing environmental conditions, geomorphological effects on site survival and visibility, or the lack of research. In that respect, recent excavations at the cave site of Bukovac near Despotovac in the Resava river valley (tributary of Velika Morava, Central Serbia) (Dogandzic et al. 2014; 2017) provide important new data relevant to the understanding of the phenomenon. The stratigraphic sequence at Bukovac is predominantly related to the Upper Palaeolithic (mainly Gravettian) occupancy, manifested by a rich lithic assemblage, hearths, bone tools and abundant faunal material. However, the Early Holocene use of the cave had also been confirmed, on the basis of partially preserved layer along the cave wall, containing animal bones which produced a Mesolithic date. Apart from dating, the taxonomic composition of the sample (including remains of wild game, mustelids, rodents, birds and a significant amount of fish bones) is unequivocally reflecting Early Holocene biodiversity and foraging (hunting and fishing) patterns. In this paper, we present the results of archaeozoological analysis of the faunal sample from the Bukovac Mesolithic layer, but also discuss the implications of its state of preservation in the broader context of Mesolithic „invisibility" in the archaeological record.

Keywords: *Bukovac cave, Mesolithic, faunal remains, Central Balkans*

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Zooarchaeological evidence for the earliest records of Holocene cetaceans in the northern Black Sea

Archaeology provides the best baseline data for presence of the Black Sea marine fauna in the early to mid-Holocene, since the sea level was low, and now the sedimentation beds are covered by sea. Modern cetacean fauna of the Black Sea is comprised of the harbour porpoise Phocoena phocoena, the common dolphin Delphinus delphis and the bottlenose dolphin Tursiops truncatus. The time of their dispersal in the Black Sea is conventionally referred to the inflow of Mediterranean waters 9-7 kya (Moura et al., 2013; Fontaine et al., 2014). The earliest Holocene cetacean remains from the Marmara Sea, western and northern Black Sea are dated as 8 kya (Çakırlar, 2013; Haimovici and Balaşescu, 2006; Matskevoy, 1977): however, these fragmentary specimens are hardly identifiable by species. The earliest identifiable record of Delphinus delphis, represented by a mandible and vertebrae, comes from Durankulak (Bulgaria) (6.5-6.2 kya) (Manhart, 1998). Here we report the earliest identifiable record of Phocoena phocoena in the northern Black Sea from the Copper Age site of Laspi 1 in the southern Crimea (Ukraine), 5.6 kya, represented by morphologically diagnosable skull fragments and numerous vertebrae, which identification was confirmed by ZooMS collagen analysis, from a few animals. A few bones were used as decorations. These findings were a part of diverse assemblage of marine fauna which was different from freshwater fauna of preceding Mesolithic assemblage from the nearly located Laspi 7. This is the evidence of growing availability of marine resources and, possibly, dispersal of marine vertebrates in the Black Sea during the mid-Holocene.

Keywords: *Cetaceans, Black Sea, Holocene, Chalcolithic, marine resources*

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Animal bones in the soot: The Zooarchaeology of Neolithic western Macedonia

For nearly eighty years, the region of western Macedonia, Greece, has been the centre of lignite mining. During the last twenty years, the Public Power Corporation (DEI) has funded a number of large-scale rescue excavations before proceeding to the destruction of archaeological sites for mining purposes. These excavations provided a unique opportunity to a new generation of Greek archaeologists to work during a period of immense financial crisis. From a purely scientific point of view, however, they produced important information for the prehistory of the region: apart from the quality of the material culture evidence recovered, the excavations yielded vast amounts of animal bones, the quantity of which has not been recovered from any other excavation in northern Greece. In terms of the available faunal data, therefore, the region of western Macedonia is ideal for exploring the nature of human-animal relationships during prehistory.

This study will present information on subsistence strategies from the region of western Macedonia during the Neolithic. It will take into consideration the faunal data from a number of sites dating from the early 6th to the late 4th millennium BC, discussing trends in animal management and placing Neolithic western Macedonia in its temporal and regional context. Within this region, the evidence suggests great variation in the use of animal resources, and vast inter-site differences regarding the scale and nature of livestock management. Overall, it is anticipated that this study will highlight the potential of zooarchaeology in the investigation of human Neolithic communities in a region that has for many years remained attached to the study of its classical past.

Keywords: *Neolithic, western Macedonia, Greece*

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The human-suid relations in Early Neolithic Europe: A case study of the Bulgarian site Dzuljunica-Smardeš

The Bulgarian site Dzuljunica-Smardeš, dating 6205-5529 Cal. B.C., is one of the earliest Neolithic sites in Europe. Both domestic cattle and domestic caprines are well represented in the zooarchaeological assemblage. Sus, in contrast, are extremely rare at the site. It is not known if the earliest Neolithic people in Europe did rear domestic pigs at all, practised some form of pig management, or only hunted wild boar.

This research investigates the human pig relationships, using biometry, kill-off patterns and isotopic dietary analysis. With this integrated methodological approach, it might be possible to characterize human-suid relationships in this pivotal early Neolithic site with greater accuracy.

Understanding this relationship at this site contributes to the broader debate on how neolithisation and domesticates spread through Europe, and which bio-cultural mechanisms were responsible for differential patterns of animal exploitation.

Keywords: *Early Neolithic, Bulgaria, Dzuljunica-Smardeš, pigs*

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Diachronic perspective on animal husbandry of the Late Neolithic settlement at Drenovac, Serbia

This paper focuses on settlement's economy of Late Neolithic Drenovac (Vinča culture; 5300-4600/4500 BC). Drenovac is a multilayered and large site (c. 40ha), located in central Serbia. The results of archaeozoological study are observed in diahronic perspective, by comparing subsistence strategies during Early and Late Vinča culture phase. Species frequency is very similar in both phases, focused on mixed herding based on cattle, caprine and pig husbandry. It seems that local tradition was of key importance in keeping the successful and stable economy, with no drastic changes throughout Late Neolithic. Unlike most Late Vinča sites, where the notable increase of cattle is noted, their contribution remains the same throughout the period, which is also the case for domestic pig. Yet, some differences were noted - the decline of frequency and diversity of wild species in the Late Vinča phase and on the other hand, the increase in number of caprines. Besides the change in frequency, the difference in caprine exploitation is documented between phases, moving from meat focused strategy to meat/moderate milk exploitation. A multi-phase faunal assemblage from Drenovac gave the possibility to discuss the changes over time in subsistence and economy of the Neolithic of the central Balkans, both on intra-and inter-site level, by observing local and regional trends.

Keywords: *Drenovac, Late Neolithic, Vinča culture, economy*

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The economy of the first shepherds in the Eastern Adriatic

Neolithic cultures in the eastern Adriatic are relatively well-known by typology of pottery forms and methods of decoration. The subsistence economy of these societies is less well known, and until relatively recently has been based on small samples and preliminary analyses. New archaeofaunal studies shed more light on the Neolithic subsistence economy while opening some interesting questions, including the complexity of transition between Mesolithic and Neolithic, and the impact of the introduction of new elements. This paper presents several case studies of Neolithic faunal assemblages in Istria and Dalmatia in attempt to reconstruct some of the subsistence patterns. The recovered evidence provides more details about the spread of herding at the start of the Neolithic and suggests some temporal changes in the specialisation of herding strategies during the Neolithic, as

well as different use of sites. These data are put in wider context to form a model of herding practices in the eastern Adriatic region during the Neolithic.

Keywords: *Adriatic, Neolithic, herding, sheep, goat*

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Where are we now? Archaeozoological investigations of Prehistoric contexts from the South-Easter Alpine region - an overview

Archaeozoological research has a long tradition in Slovenia, with the first reports published in the 19th century. For decades most scholars limited their interests to the mere zoological identification and biological characterization of prehistoric fauna, all but neglecting more complex topics and the classical as well as post-classical periods in general. Since 1980's, however, more specialized studies of animal bones started to appear, which provided to get a deeper insight into the man-animal relationship throughout prehistory. In this presentation an overview of the most significant results obtained in past three decades is going to be summarized. The discussed topics will include consumption habits, the geographical variation in animal-keeping strategies, the importance of hunting, the socio-economic structure of the settlement communities, the palaeoenvironment as well as the role of individual animal species in the mythology in the time span ranging from the Neolithic to the Iron Age. Methodologically, both the results of classical archaeozoological tools (e.g. age-at-death, skeletal element representation, metric data, traces of human activities on the bones) and more modern approaches (e.g. stable isotopes and genetic analyses, geometric morphometrics) are going to be taken into account. Of course, the purpose of this presentation is not to offer a detailed review of prehistoric archaeozoological research in Slovenia but to draw some key outlines about the present knowledge of the discussed period.

Keywords: *Slovenia, Neolithic, Eneolithic, Bronze Age, Iron Age*

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Exploitation of animal resources at the prehistoric site of Ordacsehi–Bugaszeg in Western Hungary

Large-scale excavations preceding the construction of the M7 highway in Western Hungary were carried out between 2000-2002. One of the explored multi-period sites is Ordacsehi-Bugaszeg on the southern shore of Lake Balaton that had been settled from the Late Copper to the Late Bronze Age. The zooarchaeological assemblages found here included tools and decorative items made by people representing various archaeological cultures, including the Boleráz, the Somogyvár-Vinkovci, the Kisapostag, the Incrusted Pottery, the Tumulus, and the Urnfield cultures, respectively. This rather unique succession of habitations within a single site gives an opportunity to compare the selection of raw materials, manufacturing techniques and the types of artefacts produced by prehistoric people living in Western Hungary.

Keywords: *Late Copper Age, Bronze Age, Hungary*

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Animal husbandry in the Late Bronze Age site of Taraclia-Gaidabul (Republic of Moldova)

The site of Taraclia-Gaidabul belongs to a site type known as ash mounds, although it is now known that they do not in fact contain ash at all. The ash mounds represent settlement remains of the Noua-Sabatinovka culture. There is an ongoing debate about the subsistence of this Late Bronze Age society: were they mobile pastoralists or settled farmers? Unfortunately, there is a lack of pollen

diagrams for this region and period, so landscape reconstructions are difficult. Nevertheless, it seems that the landscape was characterised by dry grass steppe. While arable farming is normally challenging in this environment, the climate was probably better suited for arable farming in the time period under discussion, due to a wetter phase. Because archaeobotanical remains are scarce, it is hoped that the zooarchaeological study can contribute to the question of subsistence.

During the first campaign (2017), more than 11,000 animal bones were recorded and studied. Preliminary results from the zooarchaeological analysis show a dominance of cattle, followed by sheep and goat and horse. Pig is rare and wild animals also played only a minor role in nutrition, although the variety among the small number of wild animal remains is considerable. It seems that cattle were exploited for both milk and labour, while sheep and goat provided meat, wool and milk. Horses were used for transport and an additional source of meat. The site not only provides evidence on animal husbandry, but on ritual practices related to (storage?) pits, involving dog skeletons and horse bones.

Keywords: *Late Bronze Age, Republic of Moldova, ash mound, pastoralism, ritual deposits*

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Exploitation of fish resources at Tanais, Southern Russia

Natural conditions and localization of the ancient town of Tanais, on the bank of the Don River and at the same time on the seacoast, were really propitious to development of fishing. Archaeological materials confirm that fishing played a particularly important role in the economic life and diet of the local society. At the site, fish remains are often discovered as layers of bones and scales. The important role of fishing is also confirmed by the numerous findings of net weights and other implements used for fishing. The model of fishing at Tanais changed throughout the centuries: different species and, most of all, fishes of different sizes were caught in the Hellenistic period and in the Roman times. It seems that fishing techniques also changed in those times. What caused these changes? When did the changes start? The study of combined archaeozoological and archaeological sources could help to reconstruct the role of exploitation of fish resources at Tanais and answer these questions.

Keywords: *Southern Russia, Don river, fish remains*

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Bartering for Bambi: Commodification of red deer antler in Middle Bronze Age Hungary

The Middle Bronze Age in the Carpathian Basin was a time of burgeoning trade or barter over wider and wider distances. Most attention has been paid to movement of raw materials and ingots used in bronze and gold production. The trade has also been tied to the value of horses who could increase speed, help carry loads and make more predictable the goods that could be carried over longer distances. Thus, the seeds of commodified products regularly and predictably moving within various incipient exchange networks existed over relatively great distances for procurement of tin, copper and gold. Regional and short inter-settlement movement of goods must also have existed but with less traceable raw materials.

Red deer (Cervus elaphus L.) was present everywhere in the habitats surrounding Middle Bronze Age sites in Hungary but population densities clearly varied. For settlements on plain or riverine areas there were clearly fewer deer herds making it difficult to collect enough antler to meet the requirements of the population. As bone loses some of its traditional importance as a raw material for clearly planned, complex tools and ornaments, a process that began much earlier from the end of the Neolithic, antler keeps its importance as a raw material for heavy-duty axe-adze type tools or sleeves-handles and increasingly antler was used for creation of high status, ornamented objects. I have argued elsewhere

for the rise of semi-specialized producers of antler objects in this period. Such workshop production implies a steady market for such objects and therefore would have required some predictability in procurement. Based on the faunal composition of sites located in ecotone zones and amounts of (largely) shed antler raw material recovered during excavation it seems these settlements had greater access than others to red deer products. In this paper I note the differential treatment of red deer antler racks and offer explanations connected to the regular demands for everyday basic tools based on antler as well as semi-specialized production of more elaborate objects made from antler characteristic of this period.

Keywords: *Hungary, Middle Bronze Age, exchange net-works, red deer antler, commodification*

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Methodologic and terminologic problems of worked bone researches in Turkey – Aşağı Pınar as a case study

The first half of the 20th century marks the beginning of the archaeofaunal researches in Turkey (Gejvall 1939) and this research area has been growing ever since. However, even though worked bone researches started in the same century and is directly linked to the fauna, it is still an area which is widely neglected. The practical, social and symbolic reasons behind why bones are utilised as raw materials, is very often disregarded in studies about what part animals played in the life of prehistoric communities. Worked bone assemblages are being treated as artefacts unrelated to social life and the natural environment. Even though it is an area where researches have been ongoing for many years, an established methodology and theory still does not exist. As a result, there is a lot of inconsistent terminology in this research area – which, in turn, is the reason why adaptive studies often cause confusion.

The scope of this study, which is based on Aşağı Pınar worked bone assemblages, is to discuss the problems mentioned above with examples and to suggest an alternative approach. Aşağı Pınar, which is located in Eastern Thrace, is a settlement which was inhabited during the whole Middle Chalcolithic Period (Anatolian Terminology). Based on the excavation and evaluation of deposits via various archaeometric techniques, it is possible to determine what kinds of applications were present in the community's life during that period. Besides that, the worked bone assemblages of the settlement in the years 5350 – 4700 cal. BC, reveal a wide spectrum. This presentation aims to discuss the methodology and terminology used in the studies by means of examples, to exemplify the typological system, to question the relationship between faunal data and bone assemblages, and lastly to evaluate the meaning of technical analysis to understand the daily routines of prehistoric communities.

Reference:

Gejvall, N. G., 1939 "The Fauna of the Successive Settlements of Troy: Second preliminary report" Årsberättelse, Kungliga Humanistiska Vetenskapssamfundet I Lund, 1 – 7.

Bone Tools, Terminology and Methodology, Middle Chalcolithic Period, Eastern Thrace, Aşağı Pınar

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Bone spoons: A case of Barcın Höyük in North-Western Turkey

Animal bone was a preferred material for tool making in prehistory given that it was sturdy and easy to find. A large variety of tools were made from animal bones and spoons are among the most striking ones. The construction of these tools requires considerable knowledge and expertise, from the selection of the raw material to their design and production. Bone spoons are rare in prehistoric settlements, probably because they were so difficult to manufacture. At Barcın Höyük, however, a Neolithic site located in northwest Anatolia (6600-6000 cal.BC), excavations yielded a rich repertoire of over two hundred samples of bone spoons of various sizes and forms. The spoons, some of which were recovered intact, range in size from modern teaspoons to dinner spoons and have round, oval or poplar leaf shaped bowls. Unfinished examples were also discovered at Barcın Höyük, indicating that these objects were produced on-site. Compared with spoons from contemporary settlements, those

from Barcın Höyük are plain and for the most part, lack decoration. After breakage, bone spoons were reused by being reshaped into spatulas, belt hooks, fish-hooks or pins. The spoons at Barcın Höyük are usually found within the architectural structures, in pits and rarely in burials. This paper discusses the spoon's purpose and considers their features revealed through analysis.

Keywords: *Bone tools, Bone spoons, Neolithic Period, Barcın Höyük, Anatolia*

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Use of animal skeletal elements as raw materials in the Early Eneolithic period in the Central Balkans

Eneolithic period in the Balkan area is marked by diverse archaeological cultures and cultural complexes. Traditional studies throughout 20th century were mainly focused on the problems of their chronological relations and on diverse aspects of the development of copper metallurgy, while faunal remains were not always carefully collected and their analyses were usually restricted.

In this paper will be presented the osseous industry from several sites of Bubanj – Hum I culture, part of the Bubanj-Salcuţa-Krivodol cultural complex, widespread in the Balkans. The most important assemblage comes from the site of Bubanj near Niš, where excavations were carried out in 1950s and again in 2008-2014, and these last campaigns provided rich assemblage of osseous artefacts, including manufacture debris. Also was analysed the material from the sites of Lazareva cave near Zlot and Begov most, both situated in eastern Serbia. Predominant raw materials were bones, mainly sheep/goat and cattle metapodials and ribs and red deer antlers. Teeth occur rarely, and occasionally even mollusc shells may be encountered. Typological repertoire consists of everyday tools, such as awls, needles, chisels, burnishers, scrapers and hammers; also other utilitarian objects such as handles were produced, while the weapons were rare. Ornaments occur in small quantities, and particularly interesting is the find of a single, fragmented flat figurine from Bubanj.

Keywords: Eneolithic, central Balkans, osseous raw materials

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POSTER PRESENTATIONS

Exploatation of freshwater mussels in the late prehistory of Southeast Europe: Case study of an Early Bronze Age settlement in Kostolac (Eastern Serbia)

Freshwater shell remains in late prehistoric faunal assemblages of Southeastern Europe have often been neglected and usually just counted, while their species level was rarely determined. Based on ethnographic data, they were usually interpreted as remnants of additional food resources, but also as food for pigs and as fish baits. Several pits filled with unionid shells have been dug up in 2012, in the course of salvage archaeological excavations of late prehistoric settlements located at the bank of the River Klepecka, near its confluence with the Danube (in the surroundings of the later Roman city of Viminacium). According to other archaeological finds, the pits were dated to the Early Bronze Age. The assemblage of more than 1000 valves offered an opportunity for a detailed morphometric study of mollusk remains. The research included taxonomic identification, specific measurements of each valve and recording of taphonomic data, such as shell color, fragmentation and artificial modifications. Three species have been identified: Unio crassus, Unio pictorum, and Unio tumidus. We discuss whether the species significantly differ according to their length, breadth and height, as well as morphological traits of the hinge area. According to contextual and overall distribution we will discuss possible cultural preference towards these species. Finally, based on contextual data and taphonomic features, we will discuss their purpose and significance within the studied settlement. The results will be placed in regional and temporal context in order to suggest freshwater shell significance in the life of people who occupied Southeastern Europe in late prehistory.

Keywords: *Early Bronze Age, Kostolac, Serbia, freshwater shell*

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New numerous finds of *Dama dama* (L.) from the Neolithic of Bulgaria support the hypothesis of the autochthonous origin of the early Holocene Balkan population of the fallow deer

The Fallow deers, is a game species, which has been introduced by man into today's fauna of Europe, including Bulgaria. According to a number of opinions, this species was imported during the Roman period in Western Europe. For a long time this has been the explanation for the existence of remains found in archaeological sites in the Balkans. Some authors suggest acclimatization of the species in Europe from the east, still in the prehistoric times. In recent years, however, the species is often found (often with significant amounts of bones) in prehistoric archaeological sites, mainly in Southeastern Bulgaria, but also in Greece since early Neolithic. The species was found in the late Pleistocene on the territory of Former Yugoslavia, and in the Neolithic of Northern Dobrudzha (Romania). During new studies in archaeological sites in Southeastern Bulgaria, a large number of remains of fallow deer were discovered. Their comparative analysis gives new data about the time of the existence and the area of distribution of the prehistoric fallow deer in the Balkans. These studies give new grounds for supporting the hypothesis of the autochthonous origin of the early Holocene Balkan population of the fallow deer.

Keywords: *Neolithic, Bulgaria, Dama dama*

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Session Title:

Conservative, consistent and comparative: Papers in zooarchaeology honoring Richard H. Meadow

Session abstract:

Richard Meadow has had a significant impact on the development of the field of zooarchaeology and on the ICAZ organization. Richard has developed an approach to faunal analysis emphasizing the "three C's" (conservative, consistent and comparative approaches) and encouraging faunal researchers to take an active role in field research as archaeologists rather than simply bone specialists. This method has spread through his influential Osteoarchaeology course at Harvard University and in intensive summer field courses in Zooarchaeology held at the Japanese Institute for Anatolian Archaeology at Kaman-Kalehöyük, Turkey. Richard's work since the 1960s has provided a valuable model for the discipline through his international, collaborative scholarship including the founding and directing the Zooarchaeology Laboratory at Harvard University which supports faunal work on a global scale; extensive field research in multiple regions including Pakistan, Iran, Syria, Turkey and China including co-Directing the Harappa Archaeological Research Project since 1992; supervising undergraduate and PhD theses on faunal projects spanning many time periods and multiple continents; and service to the discipline through sitting on innumerable committees, review boards, editorial boards, and taking an active role in ICAZ including being a founding member, serving on the IC and EC since 1976 and as Treasurer from 1998-2007. In this session, colleagues and former students honor Richard's impact on the discipline and their own research by presenting papers that address a range of topics that have been of special interest to Dr. Meadow.

Organisers:

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ORAL PRESENTATIONS

The Transition from hunting to herding in the Pre-Pottery Neolithic of southern Jordan

Animal domestication, Jordan, Pre-Pottery Neolithic, Capra, animal management

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Examining the process of early pig management and morphological change in the Tigris River Valley

One of Richard Meadow's enduring legacies is his long-standing interest in the processes of animal domestication and his commitment to collaboration, especially among his students. In his honor, we present a paper in which we combine datasets and methodologies to explore early pig management in the Tigris River Valley and adjacent regions. We synthesize and analyze the data from six archaeological sites in the greater Tigris region spanning the Late Epipaleolithic through the Chalcolithic period: Hallan Çemi (L. Epipaleolithic), Hasankyef (PPNA), Çayönü Tepesi (PPNA-PN), Sumaki (PN), Salat Çami Yani (PN), Qalat Jarmo (PN), and Tell Surezha (Ubaid-LC 1). This long temporal coverage spans 6000 years and straddles the first appearance of domestic pigs in the region. Analyzing biometrical data and kill-off patterns using updated statistical methods, we explore the trends and variability in pig management and morphological change over this timespan. We compare our data to published reports from the Upper Euphrates and comment on the process of pig domestication and spread throughout the Fertile Crescent. The data force us to reevaluate standard models of animal domestication and suggest nuances in the process itself with regard to selection pressures, gene flow, and the nature of morphological change.

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Recording and counting the "nonidentifiable:" Revisiting a fundamental methodological issue in zooarchaeology

Zooarchaeologists constantly debate the importance of long bone shaft fragments to construct skeletal element abundances and body part profiles in archaeofaunal assemblages. The skeletal element abundance counts have been largely used by zooarchaeologists to infer human decision mechanisms with specific reference to carcass transport, processing, and consequent discard patterns. These issues have been particularly approached from a taphonomic perspective considering bone density, economic utility of animal body parts, and observed bone preservation using Binford's Modified General Utility Index (MGUI) and bone mineral density values of modern species. These indices are then employed to probe the impact of various taphonomic agents.

Unlike long bone shafts, however, the importance of including ribs into faunal analyses has been under investigated, as many analysts may simply elect to discard them after labeling them as "non-identifiable." The zooarchaeological data presented here prove this approach questionable, since a very important line of evidence about past human behavior with respect to animal resource exploitation and management can be regained by simply including the ribs into the recorded bones pile, or alternatively screening randomly sampled ribs when sample sizes are too large to go through entire assemblages.

Using multiple archaeofaunal assemblages from Turkey and covering a vast temporal span from the Epipaleolithic (ca. 19,000 calibrated years Before Present or cal. BP) to the Bronze Age (ca. 5100-3200 cal. BP), this paper aims to add new data to the study of animal resource exploitation and management.

Keywords: *Methodology, quantification, body part profiles, ribs, costae*

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Counting sheep (and counting them again)

In this paper, we discuss how zooarchaeological methodological and analytic rigor require data transparency as well as consistency and clarity in data documentation. This discussion draws on ten years of working with data editing, curation, and publishing with Open Context. Open Context's current efforts in encouraging more reproducibility and rigor in zooarchaeology owes much to Richard Meadow. Meadow pioneered zooarchaeological data management with Bonecode, an influential system that has guided many zooarchaeologists in data modeling and description. His long history of service to the professional community includes establishing ICAZ and serving as a founding Board Member for the Alexandria Archive Institute, the non-profit organization that operates Open Context. This paper will highlight how the zooarchaeological community can further build upon Meadow's exemplary contributions in research and professional service so that the data we collect are accessible and useful into the future.

Keywords: *Methodology, quantification, data management, open context, open access*

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Domesticatory practices in early caprine herding: Çatalhöyük and Mehrgarh

Zooarchaeologists have devoted a great deal of very productive attention to the origins of animal domestication and to herding strategies as revealed by culling patterns. We have devoted considerably less thought to the human-animal relations of herding and the practices that sustain it. Ethnographic work on the topic can help us frame questions about how these practices developed, and the recent 'animal turn' in anthropology should produce further insights. Here I focus on how Neolithic herders worked with sheep and goats to construct a flock, and how they related to individual domestic animals.

It is more difficult for archaeologists to approach relations between living humans and animals than to study culling practices, but some burials of humans and livestock at early farming sites, notably at Mehrgarh in Pakistan and Çatalhöyük in Turkey, can shed some light on them. This joining of individual people and animals in death evokes personal relations across species in life. Herding depends on such relations, which must accommodate the nature and desires of both species.

Keywords: *Near East, South Asia, Neolithic, herding practices, sheep and*

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Subsistence economy and husbandry practices during the Bronze Age at Beycesultan Höyük

Beycesultan, located in the Denizli Province/Çivril District (Turkey), was excavated for the first time by J. Mellaart in the 1950s. A new excavation project started in 2007 directed by E. Abay. The site was inhabited from the Late Chalcolithic to the Byzantine Period. The ongoing field work revealed Byzantine, Late and Middle Bronze Age levels. The zooarchaeological studies on the finds from Beycesultan give particularly detailed information on the organization of the settlements in the 2nd millennium BC. Detailed investigations on animal bones have been carried out since 2009. The research is based on how animal husbandry practices changed at the settlement, especially during the Bronze Age.

Keywords: *Zooarchaeology, Subsistence Economy, Anatolia, Byzantine Period, Bronze Age*

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Provisioning Bronze Age cities: The role of wild animals at Acemhöyük, Turkey

Studies of urban provisioning systems usually focus on alimentary resources particularly the production, distribution, and consumption of primary and secondary products of domestic livestock. However, a combination of texts, iconography, and zooarchaeological evidence suggests that wild animals and their parts were regularly encountered in urban settings and in fact were key parts of Bronze Age societies. In this paper, I describe evidence for wild animals at the urban settlement at Acemhöyük and assess how and why these taxa were incorporated into the urban landscape.

Keywords: *Urban provisioning, wild animals, Bronze Age, Turkey, Acemhöyük*

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Reviving ancient taste: Rediscovering the Red Sea parrotfish as a delicacy of Byzantine cuisine

In the ancient world, finding exquisite fish in locations distant from the sea would have signified their importance as luxury foods for social elites. Of special interest in this respect is the Red Sea parrotfish (Scarus sp.), which was a high quality fish, especially valued in the haute cuisine of the Roman-Byzantine Empire.

Recent archaeological excavations in the Negev Desert of the southern Levant (http://negevbyz.haifa.ac.il/index.php/en/) yielded surprising and unprecedented amounts of parrotfish remains, found in the landfills of Byzantine sites located some 200km from the Red Sea. These sites, dating from the 4th-7th centuries CE (Elusa, Sobota, Obodat and Nessana), are located along the main system of ancient trade routes which connected the Arabian peninsula and the Red Sea with the Mediterranean region and Europe. The remains recovered from these sites testify to the historical importance of this fish in Byzantine economy, as well as to the development of sophisticated trade networks, which facilitated the supply of Red Sea fish to the distant provinces of the empire.

This research aims to explore the social and economic background for the increased culinary demand for Red Sea parrotfish during the Byzantine periods. Of special interest to us is to trace the route of the parrotfish from its places of procurement, through its preservation by methods of drying and salting, to its transportation to distant markets and distribution among local elites. We will place the entire process within the social context of the Late Antique meal and present an experimental culinary approach to recreate the sumptuous and luxurious tastes of parrotfish dishes.

Archaeological knowledge can now be used to bring the parrotfish back to our diet and restore its cultural value. We hope that the renewed interest in the cultural and dietary value of the parrotfish will play a future role in its biological preservation.

Keywords: *Byzantine, Negev, parrotfish, trade, cuisine*

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Feeding the Fathers: Faunal remains from the monastery of John the Little, Wadi Natrun, Egypt

The monastery of John the Little is located in Egypt's Wadi Natrun, approximately 110 km northwest of Cairo. Established some time late in the 4th century, it remained active into the 14th century, when its population declined and the site was abandoned. The monastery consisted of several buildings, as well as a church, hermitage, and cemetery. The excavations of the Yale Monastic Archaeology Project (YMAP) focused on a monastic residence (Residence B) and an associated midden. The building was well preserved, with walls surviving to 2.5 m in height in some places, and was abandoned in the 9th century. Excavations yielded faunal remains, with the majority coming from the midden. In addition to domesticates (cattle, ovicaprines, pigs, and equines), there were significant numbers of fish

bones, shells and some hunted animals. This paper explores the questions raised by the material as to the diet of the monks, the provisioning of the site, and the environment at the time.

Keywords: *Egypt, Monastery, livestock, diet, provisioning*

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In search of the origins of domesticated water buffalo in China

Recent studies on water buffalo (*Bubalus*) remains from Asia have challenged a traditional belief that water buffalo were first domesticated over 7000 years ago in China and related to rice cultivation. The preliminary results of our research on ancient DNA and faunal remains indicate that the Chinese indigenous buffalo (*B. mephistopheles*) existing during the Holocene were neither domestic nor closely-related to the ancestral population of modern domestic water buffalo in Asia. Several lines of evidence from archaeology and ethnography suggest that the domesticated swamp water buffalo is likely to have been introduced to China through the so-called Southwest Silk Road, which connected Southwest China with SE Asia, around the Han dynasty (206 BC – AD 220) when cultural interaction between China and its surrounding regions intensified.

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Cattle and water buffalo domestication and exploitation in South and East Asia

In this paper, the author explores several decades of research on the role of cattle and water buffalo in South and East Asian archaeology. In particular, the author address evidence for the domestication and movement of these taxa as well as the development of criteria for distinguishing the skeletal and dental remains of these large bovids.

Keywords: *Bos indicus, Bubalus, South Asia, East Asia, domestication*

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Animal sacrifice from tombs at Eastern Zhou cemetery of Songzhuang in Qi County, Henan province, China

In 2009, an excavation of 17 tombs at the Eastern Zhou cemetery of Songzhuang, located in Qi County of Henan Province, was conducted by the Henan Provincial Institute of Cultural Heritage and Archaeology. Sacrificed animal remains were unearthed from nine of the burials. This paper describes the animal species, elemental part representation, and results of dietary analysis of these remains (primarily those from Tomb 5), based on identification of species and age, and analysis ofstable isotopes. The animal bones are mostly left forelimbs of cattle (around 1.5 years old), followed by pigs (0.5–1-year-old) and cervids (adult Sika deer and small-sized deer), while the nearly complete skeletons of dogs, hare and fish are also present. The composition of animal species and their arrangement in the burial pits varies across tombs, according to social rank and chronological phase. Results of stable carbon and nitrogen isotope analysis revealed that even same species buried in the same tomb had differences in diet, indicating that a variety of animal resources were selected for Eastern Zhou sacrifice. The sacrificial animals recovered from the Songzhuang cemetery may shed new light on our understanding of animal consumption in Eastern Zhou funeral rites, as well as the ideologies underneath these behaviors.

Keywords: *Animal remains, animal sacrifice, funeral rites, Songzhuang cemetery, Eastern Zhou period*

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Matching dentition-based and post-cranial fusion age profiles in *Sus scrofa* using large samples of pig sacrifices from archaeological sites in early Bronze Age China

There are two systems for ageing pig (*Sus scrofa*). One is based on dentition, while the other is based on long bone fusion. Some scholars such as Lemoine and Zeder etc. recently have developed new methods for the construction of *S. scrofa* demographic profiles based on both dentition and long bone fusion in a large modern assemblage of wild boar. The study presented in this paper is a research based on their new ageing system aims at matching dentition-based and post-cranial fusion age profiles in *Sus scrofa* using large samples (more than 100) of pig sacrifices of complete skeletons from two archaeological sites, Erlitou (1750BC-1550BC) and Yanshishangcheng (1550BC-1350BC) in early Bronze Age China.

Keywords: *Ageing, Sus scrofa, dentition-based age profiles, post-crania fusion, Bronze Age China*

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Session title:

Animal domestication and biotic exchange in East and Central Asia

Session abstract:

During the Holocene, the domestication of key animal taxa prompted major transformations to human subsistence and social structure in the Old World. The mountains and steppes of the continental interior played a crucial role in the dispersal and exchange of these animal species between East and West - altering the social and biological fabric of ancient societies. This session will explore the role of animal domestication in social developments across ancient East and Central Asia, along with the processes of biological exchange that moved people and animals across these critical regions during the past.

Organisers:

William Taylor, Max Planck Institute for the Science of Human History (taylor@shh.mpg.de)

Juan (Luna) Wang, Henan Provincial Institute of Cultural Heritage and Archaeology (lunajuan1983@hotmail.com)

Discussant: Sandra Olsen, University of Kansas

Keynote speech:

Adopting a holistic approach: Integrating diverse lines of evidence for domestication in East and Central Asia

In today's world, archaeologists must adopt a complex strategy for substantiating animal domestication that investigates and compiles multiple lines of evidence obtained by a team of scientists from various disciplines. A holistic approach enables us to build a considerably more robust argument for domestication- only rarely does one piece of evidence suffice. This symposium exemplifies the rich body of tools and tactics currently in our repertoire for the verification of domestication of many species across East and Central Asia. This talk will elucidate the advantages of a broad approach by reviewing the compilation of a multifarious array of methods directed toward resolving the inception of horse domestication. Significant progress has been achieved in understanding the process of horse domestication through collaborative research integrating equine osteology, paleopathology, dental wear, soil micromorphology, geochemical analysis, remote sensing, stable isotope analysis, ancient DNA, biochemical residues, artifacts, settlement patterns and cultural change. The path traveled so far has been admittedly arduous and lengthy, but the recognition that our task is not completed should inspire a new generation of scientists to persevere toward our goal of identifying the culture(s), region, and time period responsible for this seminal event.

Dr. Sandra Olsen, University of Kansas (sandralolsen@gmail.com)

ORAL PRESENTATIONS

Tappeh Sang-e Chakhmaq (NE Iran) and the Neolithic diffusion to Central Asia

Tappeh Sang-i Chakhmaq (TSC) is an important site located in the northeast of Iran that documents the evolution of subsistence economies from the early Neolithic to the late Neolithic. Faunal and botanical remains show clear evidence of cultivation and herding during the 8th millennium BCE in this part of Iran. Hunting of wild sheep/goat, gazelle and red deer is attested during the whole sequence, while boars and onagers are under-represented in both the West Mound (early Neolithic) and East Mound (late Neolithic) settlements. The contribution of canids appears to have been very important in Tappeh Sang-e Chakhmaq, and bear remains were also found at the site. An interesting and unexpected feature is the diversity of bird remains, most of which belong to wetland species, a totally absent biotope today near the site. The presence of the gazelles indicates clearly the exploitation of steppe zones accessible to the site. The ecological information provided by wild taxa reflect the presence of a wide range of ecological niches at varying distances from Tappeh Sang-e Chakhmaq. As for the exploitation of domesticates, goat and sheep are dominant in the assemblages. Cattle are poorly represented in the earlier period, but their dietary contribution increased during the late Neolithic. This paper places the faunal assemblage at Tappeh Sang-e Chakhmaq into a wider regional context, exploring the impact of animal domesticates and discussing evidence for the diffusion of domestic animals from the Iranian Plateau to adjacent regions of Central Asia and beyond.

Keywords: *Neolithic, Iran, herding, hunting, domestication*

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To the East: Recent zooarchaeological studies concerning the spread of domesticated animals into Southern Caucasus and Central Asia

Over the past few decades, a series of zooarchaeological studies have revealed that the domestication process of ungulate mammals advanced from some 10,000 years ago in the northern part of the Near East, and that these domesticates (including sheep and goats) spread into other parts of the Old World in succeeding periods. A number of archaeological works in European countries have demonstrated the diffusion process into western areas of Eurasia. However, the chronology of the diffusion of domestic animals into eastern Eurasia is still unclear, due to the lack of zooarchaeological studies and reliable absolute dates. Recent Japanese expeditions in the southern Caucasus and in Central Asia shed new light on this issue. In this paper, we present the results of study of animal bone assemblages from Mesolithic and Neolithic sites in Azerbaijan and Uzbekistan. Results suggest that the domestic animals were introduced into these regions around 6,000 BCE, possibly as a result of migration of farmers from Near East. On the other hand, the introduction into eastern areas of Central Asia appears to have occurred after 3,000 BCE, and may relate to the domestication of pack animals.

Keywords: *Domestic animals, diffusion, Near East, Central Asia, Caucasus*

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Subsistence strategies in the Ganqing Region, China across the third and second millennia BCE

Archaeological research in the Ganqing region of northwest China has attracted scholarly attention because of its importance role in cultural interaction between East and West. From the third to the second millennium BCE, this region witnessed dramatic settlement changes, population increase, as well as subsistence changes, which was probably linked to population spread from the East. Around the third millennium BCE, domestic pig and millet from the East arrived in this region, and before the second millennium BCE, sheep/goat/cattle and wheat/barley arrived from the West. Zooarchaeological work in this region suggests that human occupants of the region incorporated these new domesticates into their subsistence strategies quite differently – millet, sheep/goat, cattle and barley were widely adopted, while pigs and wheat were not. We argue that the subsistence strategies adopted in this region were linked to unique aspects of the regional climate and environment, and the subsistence choices of this period had important influences on the the later history of this region and beyond.

Keywords: *Subsistence, Ganqing Region, Neolithic, China, domesticates*

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Earliest millet farming in Inner Asia supported pastoralist livestock amid initial east-west agricultural transmissions

The dispersal of millet agriculture out of northern China in the early Bronze Age (third millennium BCE) marked a pivotal development in transcontinental exchanges of domesticated plants and animals. After a long delay since domestication in the early Holocene, broomcorn millet was present in the steppe margins of eastern Kazakhstan by circa 2200 calibrated years (cal) BCE, but a paucity of archaeobotanical evidence and also human remains for stable isotope analysis to measure dietary intake precludes resolving millet cultivation or its importance in human diets amid this initial crop transmission. However, livestock skeletal remains recovered from settlement sites of nomadic pastoralists are abundant. We report that by the first half of the third millennium cal BCE pastoralists in the Inner Asian Mountain Corridor cultivated millet at scales large enough to provision their herds of sheep, goat, and cattle with agricultural by-product. Stable isotope analysis of livestock teeth reveals cycles of winter foddering with millet, and analysis of bone collagen demonstrates that foddering persisted over animal lifetimes. Intensive livestock foddering by pastoralists indicates that precocious cultivation coincided with the spread of millet into the steppe zone, implying that pastoralists had existing farming proficiency with Near Eastern domesticates. These results provide a unique empirical basis to understand agricultural practice by nomadic pastoralists.

Keywords: *Millet, isotope analysis, pastoralism, agricultural transmission*

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Companion or commensal? An articulated feline skeleton as evidence for adoption of *Felis* sp. at Dzhankent, Kazakhstan.

An articulated pathological feline skeleton from the early medieval city of Dzhankent is an unprecedented find from a previously pastoral region. Dzhankent was located on the northern Silk Road route from Khorezm to the trading sites on the Volga region and settled from the 7th- 8th century and later became the capital of the nomad Oghuz state by the 10th century C.E. With the advent of cosmopolitan urbanisation, it is unclear if local people adopted foreign customs, such as keeping animals as pets, alongside other imported goods and multicultural traditions. Cultures which work with livestock, such as pastoralists, do not normally have ‘pet’ relationships and instead it is cultures that are removed from quotidian interactions with animals that more readily adopt animals as anthropomorphised companions. Distance from the daily handling of livestock with the adoption of urban lifestyles may have primed people in this city to be more receptive to keeping pets. However, felines are unique in that they were believed to have domesticated themselves, having first filled a commensal role on the outskirts of human settlements. Therefore, this feline may be either a well cared-for pet or a commensal, attracted by the rodents living at this urban settlement. A biography of this unique pathological specimen is presented here, and includes geometric morphometrics, ancient DNA, and isotopic data to build a detailed picture of the life of this small cat and locate this individual along the spectrum of feline domestication.

This gives an indication of the changing fundamental nature of the human-animal relationship within a previously pastoral region and illustrates the broader social, cultural, and economic changes occurring within the context of rapid urbanisation during the early medieval period along the Northern Silk Road.

Keywords: *Pastoralism, urbanism, cat domestication, Central Asia, Silk Road*

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Tracing the emergence of horse exchange along the ancient Silk Road through 3D geometric morphometrics

Towards the end of the first millennium BCE, exchange in domestic horses across the ancient Silk Roads helped to forge new cultural and biological connections between East and West. Many historians trace the origins of this horse exchange to the second century BCE, when Han military incursions to the Ferghana Valley extracted tribute in the form of "heavenly horses" – a breed of tall, strong, and gracile horses famous for their golden color and purported to sweat blood. However, other evidence raises the possibility of an earlier onset of horse exchange between China and Central Asia. Morphological differences in cranium shape between contemporary and ancient reference populations suggest that 3D geometric morphometrics (GMM) may be useful in distinguishing ancient breed variants in the archaeological record. Applying GMM to 3D models of well-preserved crania from a funerary horse assemblage in the eastern Tian Shan Mountains dated to ca. 300 BCE, we identify key differences in cranial morphology between these horses and both modern and ancient Mongolian horse populations, including a narrower and longer face in some Tian Shan specimens. When combined with previous research using mtDNA, our results suggest incipient horse exchange between Central Asia and northwest China, or the emergence of local breeds with similar traits, along the proto-Silk Roads by ca. 300 BCE.

Keywords: *Horses, geometric morphometrics, Silk Road, exchange, 3D scanning*

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Ancient horse DNA reveals the transition of human subsistence strategy from the Neolithic period to the Bronze Age in Nenjiang River Basin, Northeast China

The Nenjiang River Basin is an important subsistence base as well as a fragile ecological and environmental area in Northeast China. Previous extensive archaeological excavations in this region indicated that hunting and gathering remained the primary human subsistence strategy in this area during the Neolithic and the Bronze Age. However, this research set out to investigate potential differences in subsistence between the Neolithic and the Bronze Age. The site of Honghe offers a unique chance to answer this question. Honghe is located on the right bank of Nenjiang River, in Honghe village, Qiqihr City, Heilongjiang Province, Northeast China. Systematic excavations were conducted from 2013 to 2015 by Heilongjiang Institute of Cultural Relics and Archaeology. The site can be divided into the late Neolithic and Bronze Age chronological components, which yielded many *Equus* skeletal remains. In the study, we conducted ancient DNA analysis of 45 *Equus* specimens using Next Generation Sequencing. Mitochondrial genome analysis indicates that the late Neolithic *Equus* remains (C-14 dated to ca.4300 BP) belong to an extinct *Equus* species, *Equus* (*Sussemionus*) *ovodovi*, which was first found in Proskuriakova Cave (Khakassia, Southwestern Siberia) dated to 40,000 BP. In contrast, the *Equus* remains dated to the Bronze Age all belong to domestic horse (*Equus caballus*). Our results suggest that human subsistence strategies actually began to change from hunting and gathering to livestock breeding, which could be related to the process of environmental change, the reduction of wild animals, or human migration and cultural exchanges.

Keywords: *Ancient DNA, subsistence strategies, Equus ovodovi, Equus caballus, mitochondrial genome*

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Mitochondrial genome analysis of horse remains from Jartai Pass, Xinjiang

The domestic horse apparently revolutionized human societies in many ways, including mobility, economy, and warfare. Horses may also have been closely associated with the spread of ideas and technology, such as Indo-European languages and new forms of metallurgy. Tracing origin and spread of domestic horse has become a core issue in evolutionary archaeology. Analysis of DNA on archaeological remains is a valuable tool for interpreting the history of ancient animal populations. However, the origin and historical expansion of local horse populations in Xinjiang of China remains poorly understood. In 2015 and 2016, Xinjiang Institute of Cultural Relics and Archaeology excavated the site of Jartai Pass (Jirentai Goukou) in Nilka County, Ili Prefecture, China. A large number of animal remains were unearthed from the site. Jartai Pass is a typical site of the Andronovo Culture dated to ca. 3600 BP. Jartai Pass is the largest and earliest Bronze Age settlement that has been found in the Ili River valley to date. We performed the NGS analysis of eight horses from Jartai Pass. Mitochondrial genome analysis showed those horses were grouped into five horse mtDNA lineages (A, A1a, R1, OP and Q), indicating complex maternal origins. The haplogroup OP has been found only in Middle East, and the haplogroup R1 has been discovered only in the horse coming from Middle East and Europe. These results suggest that the horse from Jartai Pass is probably related to the Western Eurasian horse populations, and Ili River valley may play an important role in the culture exchange between East and West.

Keywords: *Ancient DNA, Equus caballus, mitochondrial genome, Jartai Pass, Ili River valley*

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Horse exploitation by nomadic people in the Early Iron Age—the zooarchaeological case study of tomb 15 in Kalasu cemetery, Xinjiang

The Karasu cemetery is located in a grassy region northwest of Kuoketas village, Jiayilema town, Habahe county, Altai region, Xinjiang. It was excavated by the Xinjiang Institute of Cultural Heritage and Archaeology in 2014. Among 53 excavated tombs at Kalasu, Tomb 15(M15) is one of the most significant for the understanding of nomadic lifeways, as it included 13 horses buried along with the dead. We estimated age class and sex for all 13 horses from M15, analyzing abnormalities on teeth, vertebrae and limb bones through zooarchaeological methods. Using skeletal morphology and carbon and nitrogen stable isotope analysis, we discuss strategies of selecting buried horses, evidence for use of horses in riding and transport, and apparent ancient cultural links across north and south Altai Mountain range. This research provides important insights into horse exploitation strategies of nomads in the early Iron Age and fills a gap in zooarchaeological research in northern Xinjiang.

Keywords: *Xinjiang, early Iron Age, horses, Altai Mountains, isotopes*

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Paleopathology and early horseback riding along the Proto-Silk Road: Evidence from the Early Iron Age sites of Shirenzigou and Xigou, Xinjiang, China

This research examines eight horse skeletons unearthed from burials and sacrificial pits dated from the late Warring States Period to the early Western Han Dynasty at Shirenzigou and Xigou in Xinjiang, China. The horse vertebrae were analyzed for lesions such as hyperostosis, asymmetry, spinal fusion, horizontal fractures on epiphyses, and dorsal inter-pressing or joining of the vertebrae. We also identified and measured abnormalities on the nasal bones and premaxillae using a NextEngine3D scanner, then compared the data with published reference of both wild and domestic horses. In addition, bit wear on the lower second premolars were recorded. Since the abnormalities are similar to those linked with horseback riding in other early Eurasian archaeological contexts, as well as in veterinary medicine and osteology, their presence here is highly suggestive of human use for riding. This is consistent with petroglyphs discovered near the sites showing riding scenes, pathologies on human femurs, and metal bits unearthed. This study provides important clues for investigating horseback riding during the late Warring States and the early Western Han Dynasty in Xinjiang.

Keywords: *Horse riding, paleopathology, early Iron Age, Xinjiang, proto-Silk Road*

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Animal remains from Xiongnu satellite burials at Gol Mod 2 cemetery, Mongolia

Combining study of animal remains from satellite burials of the Tomb 189 complex at Gol Mod 2 cemetery in central Mongolia, with analysis of historical texts and ethnographic records, this paper discusses the funerary practices and spiritual concerns of the Xiongnu, a powerful confederacy of nomadic people that arose in eastern Eurasia between the 3rd century BCE and 2nd century CE. In the summer of 2017, Henan Provincial Institute of Cultural Heritage and Archaeology and Ulaanbaatar State University carried out the first field season at Gol Mod 2, a large Xiongnu elite cemetery located in Öndör-Ulaan sum, Arkhangai aimag, Mongolia. Twelve satellite burials arranged in an arc along the east side of Tomb 189 complex were excavated. While a number of precious artifacts made of gold, bronze, iron and gem stone were discovered, animal remains were also found in four of the satellite burials, including a skull, vertebrae, ribs and phalanges of horse, a talus and vertebrae of sheep/goat, and a nearly complete antler of Red deer (*Cervus elaphus*). Burnt bone fragments scattered around the area of stone circles and stone piles to the north of the main tomb were also identified. Although the animal remains are relatively few in number, this rare assemblage demonstrates that Xiongnu people were closely connected with animals in the central Asian steppes.

Keywords: *Xiongnu, Gol Mod 2, animal remains, funerary practices, pastoralism*

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The oldest domestic poultry in East Asia? Immature goose bones from Neolithic Tianluoshan, China

The origin of chicken (*Gallus gallus domesticus*) domestication is unknown. Although alleged domestic chicken bones have been reported from early Holocene sites in northern China, we suggested that chicken exploitation in China only began approximately 5,000 YBP. Tianluoshan is an early rice cultivation Neolithic village (BP 7,000–5,500) located in the lower Yangtze River valley, China. Recently, we analyzed bird remains from the site and found three immature goose bones (femur, ulna, and tarsometatarsus). Most wild geese are migratory, breeding in subarctic and wintering in temperate zones. If these immature goose bones are from individuals shown to have originated near the site, they may represent domestic birds. Based on osteological study, the femur and ulna were determined to be from a bird 4–16 weeks old; whereas, the tarsometatarsus was estimated to be from an animal 4–8 weeks old. Specimens between 4-16 weeks could conceivably be from birds that had migrated from breeding areas, and subsequently hunted near the site. However, the latter specimen must be from a bird that originated in the region, as 8-week old birds are too young to migrate to wintering areas. This suggests that at least the goose tarsometatarsus was from a domestic individual. Radiocarbon dating and ancient DNA analyses are required to determine whether geese from Tianluoshan may represent the oldest domestic poultry in East Asia.

Keywords: *Tianluoshan, domestic goose, domestication, Neolithic*

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Ancient bird remains from Houtaomuga, Da'an City, Jilin (China)

A number of bird remains were unearthed from the Houtaomuga Site in Da'an City, Jilin Province, Northeast China, between 2011 and 2015. The prolonged occupation of the site, lasting from the Early Neolithic period to the Liao and Jin Dynasties, can be divided into seven chronological phases. In this study, a total of 3347 bone fragments of birds were recovered, of which 2711 specimens were identified to taxonomic levels – including 20 species from 12 families and 8 orders. The assemblage is dominated by the remains of *Phasianus coichicus*, accounting for approximately 77% of the identified specimens. By observing size differences and the presence of a bone spur on the tarso-metatarsus, we reveal that the specimens of male pheasants significantly outnumber their female counterparts. Considering bird migration, we divide the bird species from the site into two categories: resident and migratory birds. It is assumed that the site was a continuously occupied human settlement, and the spring and summer are likely to be the main bird hunting seasons. During the Neolithic, the major subsistence strategy at the site appears to have been hunting and fishing, while birds served as a key supplementary food resource for prehistoric residents. The bird species hunted by people varied according to changing seasons and climate patterns across the site's occupation. It is noteworthy that in the Han Dynasty, birds became an indispensable burial offering. In addition, bird remains, as a key ecological indicator, may reflect environmental changes that occurred in the area of Hutaomuga in prehistory

Keywords: *Houtaomuga, Neolithic, historic archaeology, bird remains, fauna*

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So, why - again - did the chicken cross the road?

The chicken (Gallus galls) is the most ubiquitous domestic animal on earth. Both conventional wisdom, and recent analyses of molecular ancestry suggest that this familiar animal was domesticated in East or Southeast Asia, prior to its global dispersal. But we know next to nothing about how, or even under what conditions, the bird became part of the domestic assemblage. Here we present information and insight drawn from the Neolithic of northern China (ca. 8,000 – 5,000 BP) about the manner by which large, meaty birds (including potential precursors of the domestic chicken) were drawn into the human biome. Long before they were essential staples, they (along with a range of different, but similar birds) were an occasional and strategic feature of low-level agricultural life, itself marked by cyclical variations in the relative importance of domestic taxa.

Keywords: *Domestication, chicken, China, Neolithic*

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Evidence for the early dispersal of Near Eastern animal domesticates into the mountains of Central Asia

Ongoing research indicates that Central Asia played a critical role in both early human dispersals into Eurasia, as well as in the exchange of domestic plant and animal species during the Bronze Age and later history and prehistory. However, little is known about the timing of the initial dispersal of Near Eastern domesticated taxa or its geographic extent. Here, we present evidence on the incursion of sheep and goat pastoralists into the Ferghana Valley by the early Holocene, as represented by faunal remains from the stratified rockshelter at Obisihir-V. Careful excavation has revealed six stratigraphic units attributed to the Holocene – final Pleistocene. We analyzed bones from late Holocene layer (1,650 ± 20 BP (PLD-31751) (1,607–1,524 BP)) and early Holocene layers (7,405 ± 25 BP (PLD- 31752) (8,316–8,178 BP), 9,410 ± 30 BP (PLD-31753) (10,719–10,569 BP), conducting traditional archaeozoological identifications using comparative collections as well as taxonomic designations based on collagen structure using a technique known as Zooarchaeology by Mass Spectrometry (ZooMS).

Across all strata, ovicaprid remains are the most important component of the assemblage. The co-occurrence of mitochondrial DNA haplogroups associated with Zagros herders identified in human remains from early layers at Obishir, along with the predominance of sheep/goat in the faunal assemblage, provides strong evidence for the early incursion of animal domesticates deep into the Eurasian interior during the Epipaleolithic.

Keywords: Central Asia, Epipaleolithic, animal domestication, Zagros, Kyrgyzstan

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Session title:

Archaeozoology beyond the bones: Future and prospects of biomolecular and physico-chemical analyses

Session abstract:

Our discipline is experiencing an outstanding radiation of analytical techniques beyond the conventional study of bones. Biomolecular and physico-chemical analyses have been used on archaeological remains since the '80s but it is in the last two decades when they have been really incorporated to answer archaeozoological-based questions. A wide range of isotopic analyses applied to both animal and human remains have provided new insights about diet, food webs, environment or seasonality; animal fats recovered in pottery are making possible to better understand material culture functionality in relation with diet and a growing attention is devoted to retrieve ancient molecules from sediments, coprolithes or dental calculus contributing to enlarge the corpus of data about environment, pastoralism and diet. The aim of this session is to bring together those analyses beyond the bones and how they are contributing to our understanding of human and animal past populations, culture and environment, within the scope traditionally encompassed by archaeozoology. The session will discuss how these techniques are being incorporated into our discipline, what future prospects they are going to make possible, what concerns are being arisen with their increasingly implementation, and good practices to face those negative aspects. From the widespread use of isotopes in dietary and environmental modelling to organic residue analyses or environmental DNA, any molecular and physico-chemical contributions are welcome to address how archaeozoological research embraces this new range of analytical techniques.

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ORAL PRESENTATIONS

Wild boar or domestic pig? Bronze Age suid mandibles deposit in northern Azerbaijan, Iran, investigated through morphometric and stable isotope analyses

A Bronze Age suid mandible deposit found in Haftavan Tepe in Western Azerbaijan (Iran) stays as an enigma. Unique in Iran, Anatolia and Caucasus regions, the symbolic meaning of this find is not yet understood. Our first investigations aim at determining the wild or domestic status of these suids. Preliminar osteometric data suggested that Haftavan Tepe mandibles were larger than other suid remains from neighboring contemporaneous sites, like Kohneh Tepesi. As such, they could be allocated to wild boar.

Further morphometric investigations included simple bivariate of second and third molars length and width compared to a modern comparative collection from the Near East. This analysis confirmed the domestic status of the Kohneh Tepesi assemblage but was inconclusive in the case of Haftavan Tepe. We decided to use another proxy to investigate the status of the Haftavan Tepe suid deposit by performing stable isotope analyses of Carbon and Nitrogen on both the Haftavan Tepe and Kohneh Tepesi assemblages to investigate if the diet of the animals differentiates from one site to another.

We present the osteometric and geometric morphometric analyses combined with the ongoing stable isotope analyses in an attempt to clarify the Haftavan Tepe status of suids.

Keywords: *Suid domestication, geometric morphometrics, stable isotopes, Haftavan Tepe, Azerbaijan*

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Combining archaeozoological record and stable isotopes in human bones to understand meat consumption in the Western Mexican Highlands

With the development of stable isotope analyses from human remains, animal bones and (archaeo)botanical remains, archaeologists have at their disposal a valuable tool to reconstruct ancient diets, as soon as enough care is taken in the articulation between the different sets of data and their interpretation. This presentation aims to present a case study from the Western Mexican Highlands, questioning the consumption of meat in ancient Mesoamerican societies and the modalities of animal acquisition.

We analysed the archaeozoological corpus associated with different occupations ranging from about 500 CE to 1450 CE and performed stable isotope analyses (d13C and d15N) on both organic and mineral parts of a sample of human bones from these same sites. Some of the archaeological animal bones as well as local modern animals and botanical remains were also used to produce a first isotopic

baseline for diet reconstruction in the region. Here we present the preliminary results of this study. While the animal bones identified evidence the availability of a large diversity of species and different acquisition practices (hunting, fishing, and farming), the distribution of animal remains in the sites suggests some differential accesses that might be related with social status or sex. On the other hand, stable isotope ratios indicate a low variability amongst the populations with only few outliers and a strong reliance on vegetal products. Thus, some differential behaviours might fall outside of the detection threshold allowed by the isotopic proxies used in this study. Finally, this presentation highlights the interest of combining different markers to enhance our understanding of ancient diets and the necessity to take into account the limitation of each method when it comes to the interpretation.

Keywords: *Mesoamerica; Diet reconstruction; Meat consumption*

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Stable Isotope analysis of food waste: Creating a better understanding of Amsterdam's animal supply during the 17th and 18th century AD

This paper presents stable carbon and nitrogen isotope data of animal bone collagen as a tool of exploring animal husbandry and the provision of animals to the city of Amsterdam during two of its most prosperous centuries. It was during this period that Amsterdam grew to one of Europe's primary financial and commercial centres. This naturally led to a rapid increase in population size. That increasing number of mouths to feed required the city to procure its food supplies from regions well beyond the vicinity of Amsterdam. For example, through the extensive international oxen trade across early modern North-western Europe (Gijsbers 1999) as well as through large-scale fisheries. This study contains the first archaeological data exploring Amsterdam's history of livestock and provisioning by focussing on animal remains found amongst household kitchen waste from the former Vlooienburg neighbourhood. The extraordinary amount of refuse pits found at Vlooienburg, a district known to have been the home of many Jews, offer a unique insight into the foodways of an entire multi-ethnic residential quarter. In order to trace potential differences in meat procurement and animal husbandry amongst different religious and ethnic groups, a comparison is made with animal remains found at similar non-Jewish contexts across Amsterdam. Targeted species include, the main domesticates amongst which cattle, sheep/goat, pig and chicken, as well as non-farmed animals including a variety of marine and freshwater fish.

Reference:

Gijsbers, W.M., Kapitale Ossen: De Internationale Handel in Slachtvee in Noordwest-Europa (1300-1750), Hilversum, Uitgeverij Verloren, 1999.

Keywords: *Stable isotopes, Amsterdam, animal supply, jewish diet*

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Feeding practices among early domestic cattle in the Iberian Peninsula during the Early Neolithic: An isotopic approach

Recent research has revealed different pathways of cattle adoption during the Early Neolithic in the Western Mediterranean area. According to cattle ecological and nutritional requirements, as well as the environmental variability of the Iberian Peninsula during the Early Neolithic, it has been possible to propose different scenarios for cattle management, some of which differ from wild populations. However, to fully understand the economic implications of initial cattle husbandry and deepen in the social implications resulting from this new work process, it is essential to establish the degree of human interference in the diet of the first domestic herds and characterize the diversity of animal husbandry practices. Stable isotope analysis has opened up new possibilities in archaeozoological research and has provided the opportunity of directly studying the dynamics and living conditions of past animal populations.

In this study, we present the results obtained from stable carbon (δ13C) and nitrogen (δ15N) isotope analysis of cattle bone collagen from Mesolithic and Neolithic sites located in the north and north-east of the Iberian Peninsula. The main purposeaim of this work is to explore the changes in feeding patterns and their variability within the same herd. These results provide new insights into the diversity of cattle herding strategies during the first steps of animal domestication.

Keywords: *Cattle domestication, Neolithic, Iberian Peninsula, feeding practices, carbon and nitrogen isotopes*

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From fish, bones and sea: Assessing coincidences between sclerochronology and isotope ecology of ichthyofauna with other paleoecological proxies for the late Holocene of the Strait of Magellan (South-Patagonia), Chile

Since the mid-Holocene, the marine hunter-gatherers that inhabited the Region of Magallanes, exploited the environment in a diversified manner, consuming marine mammals, birds and fish from different habitats (San Román et al., 2016). The fishing orientation has changed over the millennia. In the late Holocene, between ca. 3500 and 2500 years BP there were considerable changes in subsistence where the role of demersal fishing increases considerably as the hunting of seabirds does too (Torres et al., 2016, Legoupil et al., 2011, Morello et al., 2012). During the last 1000 years, the ichthyological data indicate changes in the consumption patterns, represented by a diversification especially of shore fish and abundant archaeological sites scattered between the islands and fjords (op cit.). These changes in subsistence can be linked to cultural processes, however the dramatic environmental transformations during the Middle and Late-Holocene could play a decisive role in these variations.

The dramatic paleoenvironmental and climatic changes that occurred during the Mid-Holocene are well recognized on a regional and global scale, especially in relation to the change in the sea level. During the late Holocene, high fluctuations were recorded both in marine paleo-productivity as well as in terrestrial paleoecological conditions, which could affect the marine faunal assemblages.

We then present the results of sclerochronology on vertebrae of Salilota australis (Moridae) to establish their population dynamics at different times during the middle and Late-Holocene, also including analysis of δ15N and δ13C on the same samples. These results are evaluated and related to the high resolution of marine paleo-productivity and palynological records that show evident fluctuations during ca.3500 and 2500 years BP.

References:

LEGOUPIL D., P. *et al.* 2011. *Magallania* 39(2):153-164.

MORELLO, F., J. *et al.* 2012. *Magallania*: 40(2) :129-149.

SAN ROMÁN BONTES, M., *et al*. 2016. Archaeology of Maritime hunter-gatherers from Southernmost Patagonia, South America: discussing timing, changes and cultural traditions during the Holocene. In: *Marine Ventures: Archaeological Perspectives on Human-Sea*. Pp:153-170.

TORRES J. 2016. *La pêche chez les chasseurs-cueilleurs marins de la région du détroit de Magellan et des mers adjacentes, de l'Holocène moyen aux temps ethnographiques: rôle, technologie et stratégies saisonnières.* PhD Thesis in Archaeology.

Keywords: *Sclerochronology; isotope ecology; ichthyofauna; palaeoecology; Late Holocene*

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Cautionary case studies: Comments on the use of isotope analysis in zooarchaeology

Isotope analysis is increasingly seen as a key weapon in the zooarchaeologist's arsenal. It is now routinely integrated in academic research projects and is becoming ever more common in commercial archaeology. This should be praised and embraced. Generally, the more data that is produced, the more confidently interpretations can be made. However, destructive analysis should not be undertaken lightly and value judgements must always be made about the costs and benefits of the research. In addition, those who commission projects need to be mindful of the potential problems surrounding interpretation. Bimolecular archaeologists are all too aware of these, but there remains a common misconception among some archaeologists that isotopes represent a silver bullet for reconstructing past mobility, diet and husbandry.

This paper seeks to highlight some of the interpretative issues surrounding the use of isotope analysis in zooarchaeology by presenting short case studies from the UK. These will principally focus on the use of strontium (87Sr/86Sr), oxygen (18O) and sulphur (?34S) isotope data for reconstructing the

movement of animals in the past. Case studies will include Roman Caerleon in Wales, Iron Age Navan Fort in Northern Ireland and Neolithic West Amesbury in southern England. The paper will cover biosphere mapping, the aetiology of variation in isotope signals and the use of isotope data. Future directions will be discussed including the greater use of multi-isotope methods and more integration of wider environmental/archaeological evidence to disentangle issues of equifinality.

Keywords: *Isotope analysis, strontium, sulphur, oxygen, equifinality*

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Animal husbandry biomarkers in pastoral nomadic winter campsites in Eastern Mongolia: Carbon isotope ratios of plant n-alkanes in dung deposits

The animal diet foddering and relative intensity of occupation in nomadic pastoralist camps, are an important variable in mobile societies, but difficult to directly detect in the archaeological record. Here, we conduct carbon isotope analysis (δ13C) of plant n-alkanes of dung deposits associated with pastoral nomadic winter campsites in Mongolia in order to explore the origin of plant organic matter ingested by livestock and evaluate potential biomolecular signatures associated with the intensity and duration of dung deposition. Preliminary results suggest that intensity of stalling, and the composition of plants ingested by livestock are identifiable in dung samples recovered from corrals with this method. In particular, δ13C values in plant n-alkanes in dung deposits are unusually low compared to carbon isotope values of n-alkanes derived from soil control samples recovered from landscapes with minimal, if any, anthropic activity in the same ecoregion. These preliminary results highlight the importance of ethnoarchaeological studies in identifying biomarkers at the molecular scale that convey information on pastoralist animal exploitation practices.

Keywords: *Pastoralism, Mongolia, stable isotopes, dung deposits*

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When chickens colonised Europe: Dispersal routes, phenotypes and patterns of admixture based on ancient and modern genomes

Originally native to Southeast Asia, chickens have been transported to Europe solely via human-mediated means but little is known of their timing or dispersal route. Neither has any research been done on the physical appearance(s) preferred by various human societies through time. Furthermore, published studies revealed chickens interbred with other Gallus subspecies including Gallus sonneratii (Temminck, 1813) which led to domestic chickens possessing yellow legs. Despite the fact that this trait has been highly selected for in the last few centuries, the admixture between G. gallus (Linnaeus, 1758) and G. sonneratii is not believed to have been involved in the domestication process.

We here seek to investigate the spatial and temporal introduction(s) of chickens in Europe, their phenotypes and assess their admixture levels with other subspecies through time. We undertake this through the analysis of ancient mitochondrial and nuclear data from a comprehensive archaeological European chicken dataset of over 150 individuals. Particular attention was given to the role chickens played during specific time periods and geographical regions given this may have influenced selection and subsequent population pressures. Our current results show a lack of haplogroup diversity in ancient chickens, though more 'exotic' individuals were brought in Europe as part of specific cultural practices. At the time of writing, we are undertaking the phenotypic and admixture analyses through bait capture. The findings of this research are important to better understand today's genetic make-up of chickens and the implications for the future both in terms of the chickens' well-being and food security.

Keywords: *Chicken, ancient genomes, admixture, dispersals*

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Archaeogenomics of Viking Age sheep in the North Atlantic

Sheep played a central role in subsistence for the 9th and 10th century settlers of Iceland, Greenland and the Faroe Islands. They provided milk, meat, horns and wool and were very well suited to the wet and cold climate of the North Atlantic. Sheep bones are common in Viking Age excavations in the region, but little is known about the genomic composition of these sheep or their genetic contributions to modern breeds.

Using whole genome sequences of ancient and modern sheep we determine the origin of the Icelandic and Faroese sheep breeds and examine functional traits of Viking Age sheep in the North Atlantic. For this study we have selected over 80 sheep bones from archaeological excavations in Iceland, Greenland, the Faroe Islands, Norway and the UK. We compare these ancient genomes to those of modern sheep in the North Atlantic.

Our analyses will deepen the understanding of how the rapid settlement of the North Atlantic shaped population structure and genetic diversity of sheep in the region and how they have changed in the past thousand years. Furthermore, we will shed light on environmental adaptation of these animals as well as human selection of traits relating to the products produced by sheep. With the refinement of ancient DNA methodologies, it is now possible to answer questions like these which are largely outside the realm of traditional zooarchaeological analysis.

Keywords: *Sheep, ancient DNA, Viking Age, North Atlantic, settlement*

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Paleogenomics, its power and its caveats: A case study of the evolutionary history and population dynamics of bison in Europe and its adaptation to climatic fluctuations

Paleogenomics was supposed to yield more robust data than paleogenetic analyses relying on PCR amplification of genetic regions of interest. While this assumption is correct to some extent, how robust and reliable are the data themselves and the conclusions that can be drawn? Data published in the last two years on the European bison using both paleogenomics of ancient bones and genomics of present-day animals have reached different conclusions. In an effort to integrate all data and to identify underlying causes for these discrepancies, we reanalyzed and integrated all genomic data produced in the last two years and combined them with morphometric analyses of a large corpus of metacarpal bones. These analyses yielded new insights in the evolution of bison during the Late Pleistocene and the Holocene and allowed us to explore various caveats of the paleogenomic approaches that can sometimes lead to erroneous misleading conclusions.

The largest European mammal that survived into the present, the bison or wisent B. bonasus, appears in the fossil record with the onset of the Holocene, but its origin was not known. The fossil finds in Upper Pleistocene Eurasia have been mainly attributed to the steppe bison, B. priscus. Using paleogenomics analyses of the maternally inherited mitogenome, we uncovered complex population expansion, contraction and successions of various lineages in different geographical places on the Eurasiatic continent from MIS5 to MIS1 involving ancestors of the present-day European and American bison. In contrast, nuclear genome analyses reveal that regular gene flow occurred between these distinct populations, presumably mediated by males as it was not reflected in the maternal lineages. In accordance with this homogenizing gene flow, morphometric analyses reveal the high similarity of the various lineages that could not be distinguished on morphological grounds. Our analyses clearly show that previous studies concluding either that the European bison was resulting from a hybridization event between Bison priscus and Bos primigenius or that Bison schoetensacki was present in the Late Pleistocene in France were based on shaky ground due to major methodological problems involving either flawed paleogenomic or morphometric analyses. We further observed that a clear evolutionary understanding of population dynamics requires a very large sample size with a diversity of sampling in both space and time. Our analyses thus yield not only a comprehensive view of bison evolution during the last 150,000 years, but also bring useful insights in the limits of the current methods and strength of the conclusions that can be drawn.

References:

Massilani et al., BMC Biology, 2016, 14:93; Grange et al., 2018, (submitted)

Keywords: *Ancient genomes, morphometrics, European bison*

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General Session:

Europe and Southwest Asia

ORAL PRESENTATIONS

Milk and meat: Cattle in Iron-Age Ireland

The Iron-Age Irish royal site of Dún Ailinne has produced large quantities of cattle remains, which have been interpreted as evidence for cattle-based feasting. The use of a relationship-based approach provides a more comprehensive understanding of societies that relied on cattle, and the role cattle and cattle-consumption played in the Iron-Age. A carefully considering age profile constructed from tooth-wear analysis and predictive modeling of post-cranial elements has determined that cattle feasting was not at odds with an economy reliant on dairying, but rather supported it. Moreover, the needs of the Dún Ailinne cattle, in addition to what they could offer, provided the framework for the daily lives of their human counterparts.

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Animal husbandry and probable food storage the Mozgawa archaeological site of the Funnel Beaker culture (Poland, Lesser Poland)

The Funnel Beaker culture (TRB) site in Mozgawa is situated in the Nida Basin, on the eastern outskirts of the western Lesser Poland loess upland (the Małopolska Upland). In the course of previous field surveys and recent field walking, non-invasive prospection and excavations carried out in Mozgawa at 2014-16, it seems to be as one of the most important sites of this culture in Lesser Poland. This is evidenced by the site dimensions having approximately 35 hectares as well as the abundance of artefacts. Analyses of the materials have shown that this site represents one of the most intense and long-term settlements of TRB chronology.

During the excavations at Mozgawa, altogether more than 7000 remains of different groups of animals were found. In the osseous assemblage, domestic animals predominate. Among wild species, animals associated with the aquatic environment, including different species of fishes, European pond turtle, birds and some mammals are present. From the other side exploitation of open terrestrial environments is also recorded by the presence of such specimens as European hare and wild horse. Many traces of human activity were recognised on the animal remains. Besides, numerous bone and antler tools document the whole process of their production. In our poster we would like to show the results of archaeozoological analyses, which are only partly and briefly revealed up till now. Also, to discuss about the possibility that food was stored for longer preservation purposes.

Keywords: *Archaeozoology, Eneolithic, southern Poland*

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Cattle-based agriculture in the Early and Middle Neolithic in the Polish lowlands

Cattle was the most important domesticated animal in the Early and Middle Neolithic of the Polish lowlands. Different proxies of unspecified heuristic potential such as settlement location, ethnographic analogies, species composition have been used until very recently to reconstruct the character of cattle husbandry in the Neolithic. The nature of this evidence, in addition to a lack of any in-depths reflection on the complexion of husbandry practices, made these reconstructions largely inadequate, simplistic and superficial. Recent developments in archaeological sciences, advancements in faunal studies, and theoretically deepened reflection of the complex nature of human-animal relations offer unprecedented possibilities to reconstruct the complex character of prehistoric husbandry. The paper aims at presenting the objectives and some preliminary results for a newly initiated research Project, funded by the Polish National Science Center aimed at reconstructing major facets of cattle husbandry practices as well as forms of exploitation and use of this animal of prime significance for the farmers of the Early and Middle Neolithic on the Polish lowlands. It has two intertwined goals: (1) determination of the place of origin of cattle and introduction of cattle-based architecture in the Early and Middle Neolithic the Polish lowlands; (2) examination of the character of cattle husbandry, in particular recognition of the meat and milk exploitation profile as an outcome of husbandry traits of different cattle breeds throughout the studied periods. The objectives of the paper are twofold. Firstly, it intends to present the state-of-the-art in the recognition of the role and significance of cattle in different domains of the lives of Early and Middle Neolithic farmers in the Polish lowlands, in particular mastering the art of herding practice. Secondly, it will outline multi-proxy faunal and archeogenomic approaches adopted in the project to achieve the advocated goals. Arkadiusz Marciniak, Institute of Archaeology, Adam Mickiewicz University, Umultowska 89D, 61-614 Poznan, Poland; arekmar@amu.edu.pl

Mammals in everyday life of Gravettian hunter-gatherers in Central Europe

Between 30,000 and 20,000 years ago, rapid climatic changes occurred in Europe as the Scandinavian ice sheet expanded. Not only did palaeoenvironments change, but human societies also transformed themselves. A considerable cultural unification occurred in Europe, which resulted in the origin of the widespread Gravettian technocomplex. Throughout the next millennia, Gravettian hunters occupied a huge part of Europe, in an area covering several million square kilometers, stretching from the Atlantic Ocean to the Russian plains. The most distinctive features of the technocomplex is the presence of characteristic stone tools – including different kinds of backed stone implements – and female figurines ("Paleolithic Venuses"), the most famous being the "Venus of Willendorf". In Central Europe the better-known Gravettian open-air sites are located in Austria, Czech Republic, Slovakia, and Poland. The Gravettian technocomplex includes, among other phases, the earlier Pavlovian and later Late Gravettian. Zooarchaeological studies allow us to reconstruct and compare animal food resources from various sites and different periods of the Gravettian. The remains of different mammalian carnivores and herbivores were accumulated in bone assemblages at many Central European Gravettian sites. Early Gravettian (Pavlovian) bone assemblages are dominated by animals that were small (birds, hares, foxes) and medium size (wolves, reindeer, wolverines), but bones of large mammals also occur (bears, cave lions, horses, and mammoths), showing the wide spectrum of the hunters' prey choices. All sizes of animals – large (mammoths, horses), medium (reindeer), small (birds and hares) – were important components of diets and sources of raw materials. In contrast to the Pavlovian sites, Late Gravettian localities show an apparent trend towards specialization in hunting. Clear exemplars are the sites Kraków Spadzista or Milovice I, where mammoth remains dominate the osteological material. The studies were partly supported by National Science Centre, Poland (grant decisions No. DEC-2011/01/B/ST10/06889 and 2015/17/B/HS3/00165 awarded to P. Wojtal and 2015/18/E/HS3/00178 awarded to J. Wilczynski)

Keywords: *Upper Palaeolithic, hunting, Central Europe*

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The role of the red fox (*Vulpes vulpes*) in the Early Neolithic: EPPNB Ahihud as a case study.

The change observed in Levantine economic practices, starting at the end of the Epi-Paleolithic and continuing well into the PPN period and leading to livestock domestication, was accompanied by an increase in the frequencies of small sized animals of perceived lower economic rank. The red fox (Vulpes vulpes), often the prominent animal in this size category, is not always considered as a game animal. For many years the leading assumption was that it was mostly hunted for its fur. In recent years, foxes' role as a food staple was increasingly considered, especially regarding the Epi-Paleolithic. Ahihud, located in northern Israel and dated to the Early Pre Pottery Neolithic B (EPPNB-10,500-10,100 BP), offers a rare opportunity to examine the role of foxes in the site's economy during this pivotal point in human prehistory. We carried out a taphonomic and zooarchaeological analysis with the aim to understand the economic basis of the site's inhabitants during this period, immediately preceding livestock husbandry. We found a subsistence economy based on hunting, with a broad spectrum of hunted species, dominated by the mountain gazelle (Gazella gazella). Fox frequency in the assemblage is high; it is the second most common animal. Examination of fox remains demonstrates that during the EPPNB foxes were most likely hunted and used intensively both for their fur and for their meat. We suggest that the fox should be considered as a game animal in studies of animal economy of the Early Neolithic. An inclusion in the small game category may change observed patterns of animal exploitation.

Keywords: *Southern Levant, Neolithic, red fox*

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All these goats – Results from the Middle Pre-Pottery Neolithic B (MPPNB) site of Shkarat Msaied, Southern Jordan.

There is no doubt that goats were an important food source in southern Jordan during the MPPNB. The topic and geographical area has been subject for discussion for decades but there are many unanswered questions when it comes to how interpreting how these animals were exploited. Shkarat Msaied (8340-7960 BC) offers a unique window into goat exploitation in the MPPNB. Many years of excavations with systematic sieving has produced a huge faunal assemblage. Southern Jordan was a natural habitat for goats, including ibex and bezoar goats. Both species were found at Shkarat Msaied as evidenced by horn cores. Traditional zooarchaeological methods, including age-profiles and metrical data, have been studied. In addition, 3D scans help to reconstruct the profiles of fragmented horn cores to understand the ratio between ibex and bezoar goats at Shkarat Msaied. Based on age profiles (epiphyseal fusion) a high percentage of the goats were killed before the age of 3 years. This might indicate that some of the goats were managed, at least to some degree, in MPPNB Shkarat Msaied. Results from the analysis show that all bone elements from goats were brought to the site. A high intensity goat carcass processing evident and might have been part of a changed subsistence strategy specific for the goats. This paper will discuss how goats played an important role in the MPPNB in southern Jordan in MPPNB and discuss problems in interpreting faunal remains that potentially include wild goat, ibex, and domestic goat.

Keywords: *Goat-exploitation, human-animal relationship and changed subsistence strategies*

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Investigating Neolithic camel hunters at Baynunah (Abu Dhabi, U.A.E.)

During the last decade, archaeological investigations in Baynunah in the western region of Abu Dhabi have explored an exceptional deposit of ancient camel bones. The Baynunah camel site, located in an interdunal area, was discovered during pipeline construction in 2003. The desert surface was littered with camel bones, many of them in clusters. With the exception of a single flint arrowhead found on the surface and a few sherds of Bedouin pottery, no other cultural material could be associated with the site. Field investigations have been undertaken since 2008 at the Baynunah site in order to answer key questions regarding the accumulation process: natural catastrophic mortality or human intervention? According to a large set of radiocarbon dates, the bulk of the camel assemblage was formed between 4300 and 3800 cal BC. In 2015, a Late Neolithic flint arrowhead was found still embedded in the rib cage of a big male camel, and selective partitioning of carcasses has been demonstrated. The site thus represents the first kill-site known in the Arabian Peninsula, where over one hundred camels were hunted in multiple events. This has given an unexpected and unique opportunity to study the subsistence of mobile Neolithic communities and how they used the landscape and resources around them. The site has also yielded a substantial sample of wild dromedary camels, enabling biometrical and isotopic investigations.

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POSTER PRESENTATIONS

Archaeozoological data concerning the animal resources used in the settlement of Halmyris (Romania)

Halmyris (Murighiol, Tulcea district) is one of the most important Roman and Late Roman settlements located in the inferior part of the Danube Delta, in the easternmost part of Scythia province during the late Antiquity. The fort (2nd-4th century AD) and early Byzantine city (5th-early 7th century AD) experienced a long existence benefiting of strategic position. Halmyris was the most easterly point of the Danubian border in Roman times and probably served as a supply center for the fleet; early Roman inscriptions inform us of the existence of a "mariner's village"-vicus classicorum. The exploited animal resources are varied, including mollusks, fish, birds and mammals. Most of the remains belong to the group of mammals. Animal husbandry represented an important occupation. The identified domestic mammals are: Bos taurus, Ovis aries, Capra hircus, Sus domesticus, Equus caballus, Equus asinus, Canis familiaris. The predominant species are cattle and sheep/goat, both by the number of identified specimens and by the minimal number of individuals. Hunting has a small importance for the settlement under study. The identified wild mammals are: Cervus elaphus, Sus scrofa, Capreolus capreolus, Bos primigenius, Lepus europaeus, Canis lupus, Meles meles. Red deer and wild boar have the highest proportion from wild mammals. This work was supported by a grant of Ministry of Research and Innovation, CNCS-UEFISCDI, project number PN-III-P4-ID-PCE-2016-0852, within PNCDI III.

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Archaeozoological evaluation of the animal resources used in the food economy of the Iron Age fortress at Piscul Crasani (Ialomita County, Romania)

The fortified Geto-Dacian (Iron Age) fortress from Piscul Crasani is located on the right bank of the Ialomita River, on a hilltop surrounded by deep ravines on three sides that made it hard to conquer. The fortress had a strong flowering in the 2nd – 1st centuries BC, when civilian settlements were developed around it, with a rich agricultural, domestic and craft inventory; it had an important contribution to the progress of the Geto-Dacian state, run by the king Burebista. During the 2011, 2012 and 2013 archaeological campaigns, 2437 animal remains have been collected: 5 of Unio sp., 8 of bony fish, 19 of birds (of which 8 are of Gallus domesticus) and mostly of mammalian (2405 remains). Many animal remains have traces of butchering, burning, and traces left by dog teeth. Domestic mammal remains have the highest frequency (about 96%), and the identified species are: Bos taurus, Ovis aries, Capra hircus, Sus domesticus, Equus caballus, Canis familiaris. Cattle is dominant (41%), followed by sheep/goat (27%) and pig (19%). Wild mammals have a lower representation in the sample. Four species have been identified: Cervus elaphus, Sus scrofa, Capreolus capreolus and Lepus europaeus. This work was supported by a grant of Ministry of Research and Innovation from Romania, CNCS – UEFISCDI, project number PN-III-P4-ID-PCE-2016-0852, within PNCDI III.

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A new mutidisciplinary approach to zooarchaeology: Human-animal relationship at Tarquinia (Italy)

In the past few years, an increasing number of studies have pointed out the importance of integrating zooarchaeological analysis with data coming from other fields, in order to better understand and interpret animals bone remains. Indeed, many scholars are starting to understand that zooarchaeology does not only disclose past diet and butchery methods, but it also opens a window on economic, social and ecological aspects of past human behaviour. This paper brings an example of how interdisciplinarity can help zooarchaeological interpretation, combining the analysis of animal bones and of iconographic representations of animals coming from the UNESCO site of Tarquinia. Tarquinia was one of the major Etruscan cities, and the astonishing amount of incredibly well preserved archaeological remains allows the integration between faunal and iconographic analysis. This paper will argue that through the integration of different types of remains it is possible to grasp not only the physical interaction with animals, but also the socio-cultural conceptualization of these, challenging our modern way of categorising human animal relationship.

Keywords: *Tarquinia, animal perception, multidisciplinary, iconography*

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Animal scapulae and phalanges in human graves: A mystery from the Early Bronze Age in Bohemia (Czech Republic)

The presentation presents analysis of a large cemetery from the Early Bronze Age Únetice culture (ca 2200–1700 BC) at Mikulovice, eastern Bohemia, Czech Republic. Some 64 graves contained animal bone material: (a) small fragments often from the upper layers; (b) well-preserved scapulae and phalanges mostly found on the grave floor near the human remains; (c) bone artefacts. Only (b) and (c) are considered to be part of the burial ritual; (b) is the object of this study. Altogether, 40 scapulae were found in 38 graves, which means that only two graves contained more than one scapula. The scapulae belonged to cattle, sheep (perhaps goat) and pig; cattle predominate. Some 13 phalanges, from the same set of animal species, were found in 8 graves. The scapulae and phalanges have not been worked on in any way, are undecorated, and have not been smoothed by long-term use. Nevertheless, intentional selection is clear from the disproportionately high number of scapulae found at the site. As no connected, articulated body parts were observed, it is also clear that neither the scapulae nor the phalanges represent meat offerings. An earlier suggestion that the scapulae were used for digging the graves is highly unlikely as no traceological marks suggesting such use were observed on their proximal edges. While the “scapulae phenomenon” has been a well-known feature of Czech cemeteries of this culture for some time, the “phalanges phenomenon” is a recent discovery. Use of both the scapulae and the phalanges as ritual or magic objects (for example, using phalanges as amulets or talismans) is likely. There could be different explanations for the two phenomena, however: for example, the scapulae might have been used as plates. The objects could also have some symbolic function, such as representing a clan or other social group.

Keywords: *Únetice Culture, Central Europe, funeral custom, offering, magic, animal bones*

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Meat offerings and other bone finds from the Early Iron Age burial site at the tumulus at Rovná, Czech Republic

The presentation reviews the current state of knowledge concerning the animal bone finds from the Early Iron Age tumulus at Rovná, South Bohemia, Czech Republic, excavated in 2012–2013. The tumulus, which has a diameter of at least 25m and is dated to the Late Hallstatt Period (the Bylany Culture), contained one of the richest princely burials ever found in Bohemia, including imported bronze vessels and a two-wheeled chariot. The analysis may reveal details of the funerary customs of the early Celts. Manufactured bone finds are dominated by deer antler artefacts used in the decorative inlay on the chariot. Cattle and sheep/goat were reliably confirmed as meat offerings. The find of a one-year-old calf partially articulated in situ is particularly noteworthy. Analysis of the calf remains suggested that the use of body parts for offerings was selective: generally, proximal (fleshy) parts of the legs and rib segments were used, while other fleshy and non-fleshy parts were not. The Czech-wide review suggests the absence of the head and the fleshy spine area of the calf's body is typical throughout the Bylany Culture in Bohemia; the review thus details which body portions were assigned to the deceased and which were in all likelihood used in the funeral banquet. Interestingly, segments of all four legs and two segments of the left and right ribs, parts that are not anatomically joined to each other, were placed in the tomb in such a way as to resemble the form of a complete, supine animal. Other finds of interest include several phalanges of brown bear found in one part of the chamber. These are probably the remains of skin used in the funeral ritual.

Keywords: *Hallstatt Period, Bohemia, cattle, brown bear, funeral custom, rite*

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Examining the indications for the skinning of the horses from the Palaeolithic site Schöningen 13 II-4 (Germany)

At the Middle Pleistocene site of Schöningen 13 II-4 (MIS 9), a large number of faunal remains have been found (Van Kolfschoten et al. 2015). A large part of the faunal assemblage consists of horse remains, both adult and younger individuals. Cut marks present on the horse bones are, among others, associated with skinning. The underrepresentation of both caudal vertebrate and phalanges is also interpreted as indicators for skinning (Voormolen 2008). However, little is known about the process of skinning horses and other large mammals. Ethnographic and actualistic data are used to examine the possible ways to skin large mammals. These data are used to discuss the locations of cut marks inflicted by skinning, the possible representation of skeletal elements, and how this information can be connected with the features of the Schöningen 13 II-4 assemblage. Actualistic data, observed during butchering of horses, indicates that the tools only reach the bones at a few locations, mostly around joints in the legs. Ethnographic data from Native Americans shows that large mammals can be skinned in several ways, the location of the cut marks may depend on the desired object that has to be made from the skin. Furthermore, ethnographic information also indicates that Native Americans selected large mammals on age, as the skin of younger individuals was sometimes preferred. Keywords: Middle Pleistocene, skinning, butchering marks References: Van Kolfschoten, T., E. Buhrs, and I. Verheijen, 2015. The Larger Mammal Fauna from the Lower Paleolithic Schöningen Spear Site and Its Contribution to Hominin Subsistence. Journal of Human Evolution 89, 138–53. Voormolen, B., 2008. Ancient hunters, modern butchers: Schöningen 13 II - 4, a kill-butchery site dating from the northwest European Lower Palaeolithic. Leiden University, unpublished PhD thesis.

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Animal remains from an Early Bronze Age site - Tel Erani (Israel)

Tel Erani is located in the northern Negev, in the border zone between this desert and Judaea. For the present it appears that the inhabitants of Tel Erani in the Early Bronze Age relied mainly on sheep/goat and cattle for their sources of meat. Those species are dominant in the collection of osteological material of large mammals. Notably, pig remains are clearly less numerous in all strata indicating the lesser importance of that animal as a food resource. Dietary supplements were fishes from the Mediterranean Sea. Their bones confirm contacts with coastal settlements. Arguably, birds probably did not have a significant value for Tel Erani's inhabitants. All the identified bird taxa might have occurred naturally in the site's vicinity, and the birds usually hunted or widely bred by humans are not relatively overrepresented. The most numerous molluscs at the site are bivalves, mainly of the genus Glycymeris. Their shells are found in large numbers in Israel not only at seashores, but also at archaeological sites, even those located far from the sea. They may have been collected for various purposes by humans; it is possible they were used as foundations for floors, or for use in water drainage. The studies were partly supported by National Science Centre, Poland (grant decisions No. UMO-2016/23/B/HS3/01886)

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Revealing the secrets of the fossil mammals from Qau-el-Kebir

Qau-el-Kebir is located on the east bank of the river Nile, south of Asyut in Egypt. Between 1923 and 1925 excavations led by Guy Brunton and Sir Flinders Petrie, recovered hundreds of fossils in cemeteries and rock cut tombs, including fossilised human remains. The association of the fossils (including a large number of Hippopotamus remains) with cemeteries and tombs has led to speculation that they were collected as funerary or other ritual offerings to a god, or gods, possibly associated with a Hippo cult. Regardless of the archaeological aspects, this collection represents the only surviving remains of an unknown fossil deposit(s) of considerable interest on its own, and a substantial number of questions remain unanswered about the fossils themselves. Were the fossils collected in antiquity from a single deposit? What properties of the original deposit can we elucidate from the remains? Moreover, a greater understanding of the fossils can help address questions on the archaeology, such as: are the fossils dominated by Hippopotamus remains and are there more Hippopotamus remains recovered from the cemeteries than you would expect? Is there reason to think that certain properties of the fossils were preferentially selected by Egyptians in antiquity (e.g., based on shape and size) to put in the cemeteries and tombs? A taxonomic and taphonomic analysis was conducted to address these questions and the preliminary results are presented here.

Keywords: *Taphonomy, fossils, Hippopotamus, Pleistocene, Egypt*

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Fauna of ancient Shirak (Armenia)

From zooarchaeological point of view Shirak region - the north-western part of Armenia is very interesting due to its rich archaeological heritage (monuments, burials, settlements, etc.) with abundant faunal bone remains (Khachatryan, 1975). In this study we present species survey of faunal materials from archaeological excavations of Shirak region monuments. In total 9.000 faunal fossil remains were identified and analyzed, indicating the presence of more than 25 species of domestic and wild animals. Individual bone fragments and elements belonging to bird, fish and small rodent skeletons were diagnosed and analyzed, but unfortunately the identification on species level was impossible. The presence of bone remains of domestic animals in the faunal materials proves the existence of domestic animal husbandry such as large and small cattle, horse and pig. Large and small cattle remains were found from all the archaeological monuments in big numbers (76% of all fossil remains). By summarizing the results from 18 monuments of Shirak region and considering the fact that ancient Shirak was represented with combination of vast mountainous steppe landscape and woodlands, allows to assume that on the average wild animals constitute 5.4% of all faunal material. Noteworthy, the diversity of wild prey in the studied materials in which 19 mammal species. As in other archaeological monuments in Armenia, also here the skeleton remains of wild ungulates prevailed and make up 59 % of wild animals including Red deer (Cervus elaphus), Roe deer (Capreolus capreolus) and Goitered gazelle (Gazella subgutturosa). Also, it is noteworthy that other archaeological findings were found from Shirak aracheological sites such as zoomorphic figurines, sculpture animal images on ceramic and bronze crafts, as well as tools made from animal bone remains.

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Mammoth Killers and Mammoth Scavengers in the Upper Paleolithic of Central Europe

Upper Paleolithic faunal assemblages in Central Europe are sometimes dominated by bones and teeth of woolly mammoths (Mammuthus primigenius). Notably higher numbers of mammoths are found in some Gravettian sites than in others. However, mortality profiles may differ; some profiles appear dominated by juvenile mammoths, and some are dominated by post-adolescent mammoths. Part of the variability reflects climatic conditions before or during the creation of the bone assemblages. Two factors -- unstable climatic conditions and opportunistic human hunting -- contributed to the largest multiple-mammoth assemblages. In this poster, we compare Upper Paleolithic data to records of modern elephant-bone site characteristics which distinguish carcasses killed by humans from carcasses scavenged by humans or carnivores some time after the death of the elephants. The aim is to interpret the origins of multiple-mammoth assemblages in Upper Paleolithic sites. Studies of modern proboscidean carcasses have shown they are processed to different degrees by human killers -- from very full to very light utilization -- and therefore traces of human actions such as cut marks expectably vary a great deal. Freshly killed and meat-stripped proboscideans which are utilized fully have relatively shallow cut marks on long limb bones (LLBs) and may also have abundant scraping marks, if bones were recovered for use as raw materials; carnivores which scavenge the remains may create gnaw damage that is mostly restricted to epiphyses that were unfused to diaphyses. In contrast, bones from proboscidean carcasses utilized very lightly have few or no identifiable cut marks or scraping marks on LLB diaphyses, and modifications made by scavenging carnivores tend to be more extensive. When humans encounter carcasses after the soft tissue has begun to decay (during a process known as "ripening"), they may try to recover bones to use as raw materials or as fuel for cooking or

heating, creating few shallow cutmarks on or near LLB epiphyses. These and other characteristics of multi-animal bone sites can provide potentially valuable clues about human and carnivore interactions with mammoths in prehistory.

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4TH SEPTEMBER

TUESDAY

Session title:

Zooarchaeology in Turkey: Contributions to understanding human-animal relationships at the crossroads of the Old World

Session abstract:

From early work on the faunal assemblages of Troy (Gejvall 1939) to groundbreaking studies of animal domestication (e.g., Perkins 1969; Kuşatman 1991), methodological innovations (e.g., Payne 1972, 1973), insightful new analytical approaches (e.g., Perkins and Daly 1968), and multidisciplinary work incorporating archaeological sciences (e.g., Evershed et al. 2008; Richards et al. 2003), there is a long and rich history of archaeofaunal work in Turkey. Zooarchaeological research in Turkey has been pivotal to the development of ICAZ and the internationalization of the discipline. With its deep cultural sequence spanning about at least the last 500,000 years and rich and varied archaeological record, Turkey has offered unique opportunities for innovative zooarchaeological research on some of the central topics in zooarchaeology including Pleistocene hunter-gatherer adaptations, origins and spread of domestic animals, and food provisioning in complex societies. Consequently, many of the founding members of our scholarly community (e.g., Joachim Boessneck, Sandor Bökönyi, Angela von den Driesch, Richard Meadow, Sebastian Payne, Dexter Perkins, Charles Reed, and Hans-Peter Uerpmann) have made seminal contributions based on material from Anatolia.

Despite close to a century of zooarchaeological research on faunal materials from Turkey, there has never been an ICAZ session focusing on the influential and growing body of scholarship taking place in this special region at the crossroads of the Old World. The aim of this session is to celebrate zooarchaeology in Turkey at the occasion of the ICAZ meeting being held in Ankara, bringing together zooarchaeologists of all generations, creating a platform to discuss the achievements, recent developments, and the future of zooarchaeology in Turkey. As such, the session represents a first step toward compiling the scattered and fragmented zooarchaeological data to develop a diachronic picture of human-animal interaction in Turkey. We invite papers addressing all aspects of zooarchaeology in Turkey, with a preference for thematic papers.

References:

Evershed, R. P., et al. (2008). Earliest date for milk use in the Near East and southeastern Europe linked to cattle herding. Nature 455: 528-531.

Gejvall, N.-G. (1939). The fauna of the successive settlements of Troy. Second preliminary report. Årsberättelse. Kungliga Humanistiska vetenskapssamfundet i Lund: 1-7.

Kuşatman, B. (1992). The origins of pig domestication with particular reference to the Near East. University College London, London.

Payne, S. (1972). Partial recovery and sample bias: The results of some sieving experiments. In Higgs, E. (ed.), Papers in economic prehistory, Cambridge University Press, Cambridge, pp. 49-64.

Payne, S. (1973). Kill-off patterns in sheep and goats: The Mandibles from Aşvan-kale. Anatolian Studies 23: 281-303.

Perkins, D. (1969). Fauna of Çatal Hüyük: Evidence for cattle domestication in Anatolia. Science 164: 177-179.

Perkins, D. P., and Daly, P. (1968). A hunters' village in Neolithic turkey. Scientific American 219: 96-106.

Richards, M. P., et al. (2003). Stable isotope evidence of diet at Neolithic Çatalhöyük, Turkey. Journal of Archaeological Science 30: 67-76.

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ORAL PRESENTATIONS

Predomestic caprine exploitation in late Pleistocene Turkey

One of the major limitations to understanding the process of animal domestication in Neolithic SW Asia has been a continued lack of high-resolution evidence for the nature of animal exploitation systems in the late Pleistocene directly preceding the initiation of intensive management. Evidence from geographically peripheral regions such as Cyprus suggest that the intensive manipulation of animals significantly precedes the origins of animal husbandry and domestication but the nature of predomestic exploitation, manipulation and management regimes are poorly documented. In this paper, we address biometric and demographic evidence for wild sheep and goat exploitation in late Pleistocene sites in Turkey. Our main goal is to define as specifically as possible the nature of caprine hunting practices in both temporarily occupied caves sites as well as early sedentary settlements, emphasizing the diversity of relationships between humans and caprines at the PleistoceneHolocene transition and its relevance for understanding the ontogeny of practices leading to animal domestication in the region.

Keywords: *Animal management, Pleistocene, hunting, Anatolia, caprine*

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Before the revolution: Zooarchaeological insights into the Pleistocene-Holocene transition in Anatolia

Diversification and Intensification of hunting and animal resource use have long been associated with the transition from the Pleistocene to the Holocene in southwest Asia. Adopting a multivariate approach, we seek to test whether a similar trajectory can be demonstrated in the archaeofaunal assemblages from Turkey. More specifically, we focus on (1) taxonomic richness, diversity, and evenness, (2) demography of mortality, and (3) skeletal completeness to probe animal exploitation strategies and changes therein during the PleistoceneHolocene transition in Anatolia. Using primary data from Karain B, Öküzini, and Direkli caves and Körtik Tepe, as well as comparable published data from other Anatolian sites, we encompass a period from approximately 20,000 to 8500 calibrated years BP. As such, we aim to bring the Pleistocene-Holocene transition in Anatolia to a sharper focus and to provide zooarchaeological insights into the behavioral strategies of the last hunter-gatherers and first farmers in Anatolia.

Keywords: *Pleistocene-Holocene transition, hunting, diversification, intensification, Anatolia*

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Human-animal relations at the Neolithic village of Boncuklu Hoyuk, central Anatolia

The 9^{th} to 8^{th} millennium BC occupation at Boncuklu Hoyuk in the Central Anatolian Plain presents the opportunity of exploring human-animal relations at a small early Neolithic settled village. Zooarchaeological results demonstrate a contrasting picture to major reliance on herd livestock seen at the adjacent and immediately succeeding site of Catalhoyuk. Rather, it shows how the Boncuklu villagers primarily hunted, trapped and foraged a wide array of wild animals both in their immediate wetland and grassland vicinity, and in more distant wooded uplands. There are no hints of pressure on animal populations in this landscape, despite the sedentary nature of the site. Human-animal relations are revealed through a series of symbolic animal part installations in domestic contexts, which can be seen as foreshadowing the flourishing animal art at later Catalhoyuk. The next phase of zooarchaeological research at Boncuklu Hoyuk, involving Geometric Morphometrics of *Sus scrofa* remains to probe questions of animal status is also outlined in this presentation.

Keywords: *Pre-Pottery Neolithic, Central Anatolia, Sus scrofa*

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Forager-herder trade off, from broad spectrum hunting to sheep management at Aşıklı Höyük, Turkey

Aşıklı Höyük is the earliest documented pre-ceramic Neolithic mound site in Central Anatolia. The oldest deposits at the base of the mound (Levels 4 and 5) span 8200 to ca. 8500 cal BC, associate with round-house architecture and arguably represent the birth of the Pre-Pottery Neolithic in the region. The meat diet of these early occupants consisted of diverse wild ungulate and small animal species and hence was quite broad. The meat diet narrowed gradually over just a few centuries to an exceptional emphasis on caprines (mainly sheep). Age-sex distributions of the caprines indicate selective manipulation by humans by or before 8200 cal BC. Primary dung accumulations between the structures demonstrate that ruminants were held captive inside the settlement at this time. The zooarchaeological and geoarchaeological evidence together demonstrate an emergent process of caprine management that was highly experimental in nature and oriented to quick returns. Stabling was one of the early mechanisms of caprine population isolation, a precondition to domestication. The village environment meanwhile was invaded by a variety of commensal rodent and anura (mainly toad) species during the early occupations. Cricetulus migratorius and Apodemus sylvaticus are most abundant rodents. Their strong attraction to wheat and barley seeds is well known, but the distribution their skeletal remains and feces within the site is biased to building features. The human-built environment also proved attractive to toads, which greatly outnumber frogs despite the close proximity of the Melendiz River.

Keywords: *Pre-pottery Neolithic, Central Anatolia, zooarchaeology, caprine domestication, stabling deposits*

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Avian resource exploitation in Neolithic Hasankeyf Höyük, Turkey: Bustards for feather and pheasants for meat

Hasankeyf Höyük is an early sedentary Neolithic village (9500-9000 BCE) located in the Upper Tigris Valley, southeast of Batman, Turkey. A series of round-shape houses have been found, except at the upper-most occupation phase of the site, where we found square-shape houses. The majority of animals found at the site are wild, except for a few dogs. Sheep was the most important game, followed by wild boar and red deer. Fish and bird bones were also abundant. This paper is the first report of the study of bird remains from Hasankeyf Höyük. To date, we found bustards (Otididae), pheasants (Phasianidae), geese (Anserini), owls (Strigidae), hawks (Accipitridae), ducks (Anatinae), swans (Cygnus), and doves (Columbidae). Of these taxa, bustards and pheasants were dominant, followed by geese, but other taxa were sporadic. Most of the bustards and geese bones consisted of carpometacarpus, phalanx proximalis digiti majoris, and other bones of wing digits whereas bones of leg, trunk, and proximal wing (i.e., humerus, ulna, and radius) were rarely found. These findings

suggest that only distal wings, probably with primary feathers, were selected and imported to the site. A similar trend was observed for owls, suggesting strong demands for their primary feathers with less interest in their meat. Conversely, shoulder girdle and leg bone elements of pheasants were common, suggesting that these taxa were possibly exploited for their meat. We will discuss the characteristics of avian resource exploitation and their transportation into Hasankeyf Höyük, comparing this site with other Neolithic sites in the region.

Keywords: *Hasankeyf Höyük, bustards, pheasants, feather exploitation*

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Disentangling human decision-making in early Neolithic Anatolian communities based on ruminant body part distributions

Since the study of Perkins and Daly (1968) postulating a “schlepp-effect” at Neolithic Suberde, skewed skeletal distributions of major game species have been considered reflecting decision-making by ancient hunters. Severe criticism to initial interpretation of the Suberde data led to more rigorous approaches to the use of body part distribution in order to unveil human behaviour at the kill site and the logistics of body part transportation in past communities. Here we present the results of our analysis of carcass treatment of ruminants in (semi)sedentary early Neolithic sites located in Anatolia. In contrast to previous work considering skeletal inventories and body part utility indices, however, we consider skeletal weight a valuable alternative for documenting the “schlepp-effect”. We thus used the weight of modern reference skeletons of ruminants (Gazella, Ovis, Capra, Bos, Cervus) as a baseline to evaluate body part distribution in game species from 10th-9th millennium BCE Göbekli Tepe and Gusir Höyük in Southeast Anatolia and from 9th-8th millennium BCE Aşıklı Höyük in Central Anatolia. Our analysis shows that the communities of hunters exploiting the site catchments of Göbekli Tepe and Gusir Höyük exhibit parallels in carcass treatment and body part transportation,

whereas sociocultural behaviour at Aşıklı Höyük, a transitional site witnessing early sheep and goat domestication, clearly differs. However, a closer look at the intra-site distribution of faunal remains from distinct contexts, such as midden deposits or elaborate architectural structures reveals differences both in taxonomic composition and body part representation. In the latter structures, for instance, male bucrania and horn cores are statistically overrepresented. Conceivably the role of these items was multifunctional, e.g. to commemorate important symbolic events as part of the collective memory of that community or to perform rituals. In sum, addressing phenomena of differential transportation of body parts necessitates a good understanding of the site's archaeology and taphonomic history, since within a single site ruminant body part representation may differ significantly according to the archaeological context, thus prohibiting inferences and generalisations about early Neolithic socio-cultural behaviour in the case of spatially limited datasets.

Keywords: *Early Neolithic Anatolia, body part representation, Schlepp-Effekt, bone weight, intra-site analysis.*

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From hunting to herding – horses in ancient Anatolia

Archeozoological, chemical and genetic studies have identified the Pontic-Caspian steppes as the region where horses first have been domesticated during the 5th to 4th millennium BCE. From the Near East, however, it is known that horses became rapidly a dominant part of elite culture restructuring political, economic and social relationships. Textual, iconographic and archeozoological data suggest that domesticated horses were imported into Mesopotamia from neighboring highland regions by the late 3rd millennium BCE. It is not clear, however, whether the horses that were imported from Anatolia into Mesopotamia were the descendants of domesticates form the steppes or whether there was (also) local domestication of wild horses. In particular, there are indications for equid exploitation including hunting of indigenous wild horses (*Equus ferus*) and the so-called hydruntines (a subspecies of wild hemione, or half-ass, *E. hemionus hydruntinus*) across Holocene Anatolia. Therefore, it was our aim to adopt a paleogenetic approach to analyze the emergence of domestic horses in Anatolia. To do so, we analyzed mitochondrial and Y-chromosomal DNA as well as autosomal markers associated with the coat color in Holocene horse remains. This allowed us to follow the dynamics of these genetic markers over time and to compare the genetic landscape of Anatolian horse populations with a continuous chronological coverage from 6000-1000 cal BCE, from the early Chalcolithic to the Iron Age, i.e., before during and after the domestication period. The obtained results enable us to draw clear-cut conclusions about the role of autochthonous domestication and importation in the appearance of domestic horses in Anatolia, as well as the contribution of the Anatolian wild horse to the gene pool of the domestic horse.

Keywords: *Horse domestication, paleogenomics, Anatolia, Equus ferus, Equus caballus*

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Subsistence strategies and use of the natural environment at late Neolithic Çatalhöyük, Turkey

Çatalhöyük is a well-documented Neolithic site (7100– 5900 cal BC) located in Central Anatolia, Turkey. Among the topics elucidated by research at Çatalhöyük are the spatial organization of the settlement, the significance of animals in the Neolithic, and the process of animal domestication. Research into fauna on the site has been ongoing for many years, and its results have contributed to the achievements of zooarcheological research into faunal material in Turkey, which this dedicated ICAZ session intends to present. One of the most important aspects of daily life at Çatalhöyük was the acquisition, processing, and preparation of the food necessary for subsistence. Subsistence strategies are the set of actions and measures chosen by people in a specific place and at a specific time to obtain the means necessary to survive and reproduce as individuals and as a group (Huguet et al., 2013). The aim of this presentation is to present the practices of subsistence and food processing, as well as the use that was made of the natural environment. This will be shown using faunal results from the excavation areas on the East Mound, focusing on the Late Neolithic phase of the settlement's occupation. Issues such as husbandry, food-related practices, and depositional practices will be addressed in this presentation.

Keywords: *Subsistence, Late Neolithic, Çatalhöyük, Turkey*

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Sorting the sheep from the sheep/goats: Identification biases, ZooMS, and changing husbandry practices at Neolithic-Chalcolithic Çatalhöyük, Central Anatolia

Amongst many methodological innovations first applied in the context of Turkish zooarchaeology, two stand out for their importance (current or potential) to studies of past sheep and goat herding practices. These are the standardised Payne dental ageing system developed at Aşvan Kale (Payne 1973) and the ZooMS collagen fingerprinting method first applied to identify sheep and goats at Domuztepe (Buckley et al. 2010). This paper brings the two together to (a) explore changing caprine husbandry from Neolithic to Chalcolithic at Çatalhöyük, central Anatolia, and (b) assess the impact of identification biases on a widely used method. We demonstrate a clear age-correlated bias in rates of identification of mandibles to species, with older animals more likely to be recorded as "sheep/goat". Considering only those specimens identified to species level (as is widely recommended) thus automatically biases mortality profiles towards younger individuals—an effect that appears to hold for published assemblages elsewhere. We therefore apply ZooMS to 290 caprine mandibles from four phases at Çatalhöyük, including the Chalcolithic West Mound, to enable more reliable species-level assessment of changing husbandry practices. Results reveal a previously undetected shift in management between the Neolithic levels and the West Mound, coinciding with broader changes in settlement patterns and landscape use on the Konya Plain but contrasting with the impression of continuity given by taxonomic frequencies. ZooMS also reveals a 14% error rate in the original morphological identifications, the wider implications of which for studies of prehistoric herding in the region, and particularly for meta-analyses, are considered.

Keywords: *Culling patterns, caprines, Ovis, Capra, collagen fingerprinting*

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Arslantepe: The day after – EBAI (3000-2750 BC) faunal preliminary report

The period covered by this research starts when the most flourishing phase in the history of Arslantepe (Period VI A) came to an end, and the powerful Early State centre that had developed in the second half of the 4th millennium BC, being manifested in a precocious monumental palatial complex, underwent a final collapse marked by a devastating fire. The site was gradually reoccupied (Period VIB1) by seasonal settlements of wattle and daub huts scattered on the ruins of the palace and long fences of wooden posts, possibly animal enclosures, whereas an outstanding mud-brick communal/public building and a special fenced area with a single large hut, probably the chief hut, stood out on the hilltop. The composition of the livestock consisted almost entirely of caprines and of few cattle with the occasional remains of pigs and wild animals. This is a time characterised by a decline in beef consumption, indicated by the smallest amount of cattle remains ever recorded in the animal bone assemblage of Arslantepe, and the pig bones virtually disappear from the sample. This picture is well in keeping with the behavioural patterns of groups that traditionally practiced a form of mobile pastoralism, in connection with the expanding communities of the so-called Kura-Araxes culture. Shortly after, the settlement took the form of a rural village of mud-brick houses built around a big fortification wall on the top of the mound. In a relatively short period of time, Arslantepe appears to have been settled again by local sedentary population, and new cultural relations with the post-Uruk communities of the Turkish Euphrates valley were re-established. In this period (Period VIB2) the settlement became stable again and the animal breeding practices, though similar to those of the previous period, highlight the tendency towards a pastoral economy aimed at the full exploitation of all the productive qualities of the flocks and at an increase in cattle, the latter being perhaps an indication of a renewed importance of agriculture.

Keywords: *Early Bronze Age, pastoralism, Upper Mesopotamia*

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Funerary meals at Tatika: An EBAI-II graveyard in Southeast Anatolia

For northern Mesopotamia, the third millennium BCE represents a period of great transformation of social, economic, and cultural values. The site of Tatika is located on the eastern bank of the Tigris River and is one of the excavations conducted within the scope of the Salvage Project of the Ilısu Dam and the HEP Project. Based on the architectural characteristics, it is understood that Tatika was used for dead rituals rather than domestic purposes. In archaeological records, it has been shown that some structures have foundations built as regularly shaped long rectangular blocks, some chambers are furnished with large flat stone slabs, and into the foundations is a single chamber with infant burials that were placed in each phase. In addition, several infant and child burials of different types were placed into some of these chambers. Animal bones were also found associated with the human bones in the chambers. It is believed that these animal bones were residues of funerary meals. The identified portion of Tatika faunal assemblage consists of 1543 fragments, which were collected from pits and around stone walls. This bone assemblage is dominated by domestic animals: sheep, goat, pig and cattle. Wild taxa including deer, turtle, bird and fish, are also found, though in low numbers. Because the information on grave architecture is absent from the other excavation sites around Upper Tigris, the results of this study are crucial to elucidate the overall ritual activities in the region.

Keywords: *Ritual, Upper Tigris Region, Tatika, Southeast Anatolia, Early Bronze Age*

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Pastoral economy in Southeastern Anatolia from the Middle Bronze to the Iron Ages: A zooarchaeological assessment

This paper presents the results of the zooarchaeological studies conducted during the past decade on animal bone remains from three different sites explored by the Joint Turko-Italian Project near the Turkey-Syria border in Southeastern Anatolia. The analyzed sample includes more than 20.000 fragments retrieved during archaeological excavations in the urban centers of Tilmen Höyük and Taşly

Geçit Höyük in the Islahiye Valley along the Kara Su River, and in the large urban center of Karkemish in the middle Euphrates Valley. On the whole, this large assemblage describes the animal economy of an ecologically consistent region between the Middle Bronze Age and the end of the Iron Age period (ca. 2000-550 BC). The animal exploitation in these three sites was largely based on pastoralism and only occasionally complemented by hunting activities, which led to the discovery of a quite differentiated assemblage of wild animals. Domestic animals were predominant at the three sites in all the explored periods, index of an intense anthropic modification of the territory. At Tilmen Höyük (Bronze Age) and Karkemish (Bronze and Iron Age), sheep and goat are by far the most represented animals in each phase, followed by cattle in all chronological period analyzed. At Taşlı Geçit Höyük (Bronze Age) the most frequent animals were instead cattle, followed by sheep and goats. These different patterns of animal exploitation reflect different strategies implemented for obtaining primary and secondary animal products probably not due primarily to local variations in the ecological conditions, but probably manly to differences in the socioeconomic and political organization of the sites.

Keywords: *Pastoralism, Southeastern Turkey, Bronze Age, Iron Age*

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An evaluation of zooarchaeological finds in Turkey from Late Antiquity to Seljuk times

Turkey has been the theater for many great steps taken by the humankind at various times. Being central to most exciting cultural developments at "the dawn of civilization", if we were to use such a term, much of archaeological and zooarchaeological research has focused at these early periods. Later times, even though worthy, have been studied less intensively by zooarchaeologists. This presentation attempts to illustrate the contributions zooarchaeology can make to the study of later periods though a discussion of zooarchaeological finds dating from Late Antiquity to Seljuk period including data collected by the author and review of published reports. It will first draw a picture of what we know about animal economy based on species proportions and mortality profiles and pinpoint the main achievements and remaining gaps of knowledge. It will conclude with reference to major research questions as these spring from both zooarchaeological data as well as our knowledge of the political, economic and administrational features of these periods which are postulated to have an impact on animal husbandry.

Keywords: *Medieval, Turkey, animal husbandry*

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Between Southeast Europe and Central Anatolia: Zooarchaeology of Western Anatolia

We present an overview of recent zooarchaeological research in western Turkey, a vast region between the Anatolian Plateau and the Aegean Sea, including the region around Istanbul. Despite an early start with Schliemann and Virchow, work on the common human-animal past in the region has been confined to few sitebased zooarchaeological studies, masking their potential contribution to the cultural and environmental narrative of the region and beyond. Recent zooarchaeological research has shown that the region carries pathbreaking potential for elucidating patterns of human–animal relationships in both prehistoric and historic periods. Here we discuss the zooarchaeological evidence from the Palaeolithic through historical times, and highlight the results of zooarchaeological research from the region with specific focus on Epipalaeolithic foraging, Neolithic husbandry, urban animal economies, and human impact on wild animal populations.

Keywords: *Zooarchaeology, Aegean, western Anatolia*

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The cultural history of the Anatolian fallow deer: 20k BP – present

Despite its name, the European Fallow deer (Dama dama dama) is native to the Eastern Mediterranean and it is generally considered that the species' glacial refuge was Anatolia. Today, Turkey is home to the last surviving wild population, which is under threat of extinction. Beyond Turkey, however, fallow deer populations are thriving. They have been established around the world, their distribution almost exclusively the result of human translocation.

Recent research has resolved the timing and circumstance of the fallow deer's global diffusion. This paper brings together data from genetics, isotopes and traditional zooarchaeological analysis to show how the fallow deer-human relationship has changed through time in Anatolia, set within a broader context. Beyond this, it shows how this deep-time understanding may be the key to fallow deer conservation.

Keywords: *Fallow deer, Dama dama, human-mediated diffusion*

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POSTER PRESENTATIONS

The Last Elephants of the Euphrates: Elephant bones with cut marks from Early Iron Age levels at Karkemish, Turkey

The poster presents the preliminary zooarchaeological analysis of four elephant bones with anthropogenic modifications found at Karkemish in 2016 by the Turco-Italian Expedition at Karkemish, Gaziantep – Turkey, under the direction of Prof. Nicolò Marchetti. Elephant bone remains were found in a side room from the latest phase of a storage complex in Area S (King's Gate), which dates to Iron Age I according to pottery evidence (12th -10th centuries BCE). This exceptional discovery gains further importance in consideration of the lively debate about the existence in the Near East of a species called Syrian or Western Asiatic elephant (Elephas maximus asurus), which went extinct before the mid-first millennium BCE. Textual and iconographic evidence from Egypt and Assyria, supported by the discovery of several elephant remains (teeth, tusks and post-cranial bones) at various sites in Northern Levant, shows royal hunts, capture and display of living elephants in the region. The elephant bones found at Karkemish might therefore throw light on the last phase of elephant's presence in the Near East. Moreover, the cut marks detected on the Karkemish finds provide additional information on the exploitation modes of this versatile mammal.

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Meat for the feast? The animal bones from the West Sanctuary at Troy (Turkey)

Based on new osteological evidence from the West Sanctuary, this poster reviews the role of animals in providing the meat for (ritual?) dinning within the sacral space of Ilion/Troia VIII. During the Hellenistic period, the city primarily served as religious and administrative centre and was not heavily populated. The archaeological and textual records indicated that the West Sanctuary, which laid at the southeast from the citadel, can be identified with the Samothracian Gods coexisting with worship of Dardanos and Cybele. In 2002, during new excavations of the Project Troia realized by the University of Tübingen and University of Cincinnati, the large pit filled with animal bones and ceramics (130-100 BC), connected with the construction of Temple B, have been discovered in sector z8. The recent evaluation of bone assemblage suggested that the variety of dishes prepared from at least 25 individuals of cattle, pig, sheep, goat, horse, donkey, chicken (cock), aurochs, fallow deer, roe deer, hare, birds, and fish, were consumed, probably during a single event. According to skeletal element distribution and butchery marks observed, the meat was prepared either in sanctuary (through sacrifices?) or brought here cured. Unlike food remains from residential areas, cattle and pig bones mostly represent the best and mid-quality cuts, illustrating the wealth of participants or intention to eat better on special occasions. The deposit also shows higher proportion of equids, which is in concordance with previous investigation on leftovers from the sacral areas and denotes their symbolic and/or economic importance for Hellenistic Ilion.

Keywords: *Hellenistic Troy, West Sanctuary, animal bones, food leftovers*

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Session title:

High-resolution analyses of dental remains: Broadening horizons

Session abstract:

In the last years, the study of dental remains from archaeological sites has been improved significantly with high-resolution techniques bringing new insights to understand past societies. This potential is related to the application of new methods or improvement of existing methods that provide high resolution data about the life history of both human and animal populations. These include a better understanding of individual demographic parameters (ages, sex), individual dietary patterns, territorial mobility, animal husbandry techniques or hunting strategies. They contribute to provide a better knowledge of human palaeoecology, subsistence and social behavior. The objective of this session is to bring together presentations and discussions on the last advances on the analyzing dental evidences in the archaeological record. Themes are related to palaeoecology and zooarchaeology. Topics include dental morphology, biometry, geometric morphometrics, stable isotopes, trace-element analysis, tooth micro- and mesowear analyses, and cementum analysis.

Organisers:

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ORAL PRESENTATIONS

Contribution of ecometric methods to describe local environments: The case of the Middle Pleistocene site of Lunel-Viel (Hérault, France)

Lunel-Viel caves are a well-known archaeological and paleontological Middle Pleistocene sites located in Southeast France. During the 80's, paleontological studies, especially on horse remains, suggested that the paleoenvironment could have been partly swampy similar to the current Camargue swamps in the Rhone delta. The horse species from Lunel-Viel was even named according to its supposed biotope: *E. mosbachensis palustris*. This species was associated with aurochs, *Bos primigenius trochoceros* indicating also temperate and plains biotopes. In this presentation, I would show that the use of dental wear analysis combined with traditional biometric and morphometric studies allow to test and discuss past assumptions as well as to provide new hypothesis about paleoenvironmental reconstruction. Morphometric characters on the horses' skeleton suggest a humid and probably forested environment with a loose soil. Moreover, the large ungulate teeth from Lunel-Viel were compared to a collection of modern horses and bovids teeth collected from the Tour-du-Valat, a conservancy Park located in the Camargue area. Both meso- and micro-wear data show significant differences between current and past animal populations. Thus, we can conclude that the Lunel-Viel ungulate feeding habits are inconsistent with a swamp biotope. The combination of morphometric and dental wear data is particularly relevant to better describe past local environment and precise climatic and landscape parameters. For Lunel-Viel, the climate must have been relatively warm and moist with a striped landscape dominated by the forest with some open area. Those informations are important to better understand the lifestyle of the pré-Neanderthalien groups who occupied occasionally the caves, and potentially hunted or scavenged such herbivore preys.

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Teeth osteometry as a tool: Evaluating white-tailed deer hunting sustainabilty, at Nueva Esperanza site (Colombia)

Complex social interactions in the access to protein resources in pre-Hispanic societies can be understood by using the archeological remnants of animal consumption. Venison was the most common protein in the diet of the pre-Hispanic settlers the high lands of central Colombia. The relative abundance of vestiges of white-tailed deer, *Odocoileus virginianus* (Zimmermann, 1780), can be used as an economic index for pre-Hispanic societies. Here, we use changes in the proportions of pray by age groups to evaluate the consumption sustainability. Our research explores a quantitative methodology to determine the white-tailed deer age by using an osteometric analysis of the teeth. Although there are alternative methodologies to establish the deer's age range by studying the entire mandible, archeological discovery rarely provides a full mandible to work with. Instead, our proposal provides a new technique using measures of height and width of each dental piece which are more likely to be found in archeological sites. We analyzed 225 dental pieces of *Odocoileus virginianus* obtained at Nueva Esperanza site, located near Bogota, in the highlands of Colombia. We present a reference table that maps the height and width of each dental piece to the individual's age group.

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From pannage to sty keeping: A geometric morphometrics study of tooth size and shape differences between Medieval and Post-Medieval English pig populations

The transition between the Late (1400-1500 AD) and Post Medieval periods (1500-1750 AD) in England is very important for the history of pig management, as this is the period in which some of the mechanisms of breed selection and livestock improvement, which have so deeply influenced modern husbandry, have their roots. One of the main changes sees the progressive replacement of pannage with sty-keeping, which meant a greater control over the animal life cycle and also generated the opportunity to test selective breeding and pursue breed improvements. Zooarchaeological records for the end of the Middle Ages provide some indication of the impact of such change on the size and shape of pigs. An increase in size has been detected in both postcranial bones and teeth, even though bones were far more affected. A further, greater, increase in pig size has been recorded in the Post-Medieval levels and, interestingly, the Late and Post Medieval pig bones increased in size relatively more than teeth. Since changes also affected the more conservative teeth, rather than just bones, were the Late Medieval pigs genetically different from the Medieval animals? Moreover, since bones increased in size far more than teeth, does this confirm that the increase in body size was accompanied by a shortening of the snout? This paper will present the preliminary results from a two-dimensional Geometric Morphometrics study of medieval and post medieval pig teeth from several English sites to address these questions and gain a better understanding of the profound changes that took place in England during this period.

Keywords: *Geometric Morphometrics, pig teeth, Late Medieval-Early Modern period*

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The use of dental morphology and stable isotopes to distinguish between indigenous sheep and goat breeds in Southern Africa

Separating archaeological sheep and goat remains has long been recognised as a zooarchaeological challenge. Little work has been done on this topic in Africa, where local breeds of sheep and goats differ from better-studied European and Western Asian varieties. Balasse and Ambrose (2005) identified differences in the shapes of second and third molars in Kenyan sheep compared with goats; they were also able to distinguish the two on the basis of stable carbon isotope analyses. We are testing these criteria in South Africa, investigating different breeds of indigenous fat-tailed sheep and veld goats, as well as some improved breeds. Stable carbon and nitrogen isotope measurements should distinguish sheep from goats within an ecologically homogeneous area. Sheep prefer graze to browse, so in summer rainfall areas where the grasses are C_4, sheep tend to have more positive $\delta^{13}C$ values than goats, since goats tend to browse more (and graze less) than sheep. Our results to date, show that there are differences between the morphologies of sheep and goat molars, but the distinction is complicated by significant inter-breed variation. Isotope measurements successfully separate sheep from goats within restricted areas, but small-scale environmental variations (e.g. in vegetation type or altitude) can obscure the distinction. This is, to our knowledge, the first study to explore inter-breed morphological differences in domesticated sheep and goats in Africa.

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Caution required when using oxygen isotope ratios derived from sequentially sampled bovid teeth to establish mobility

Carbon isotope analyses of sequentially sampled herbivore tooth enamel are now commonly employed to investigate seasonality of livestock diets in ancient agricultural and pastoralist societies across Eurasia, while oxygen isotopic time series are increasingly used as means to trace mobility across disparate environments. However, the oxygen isotopic composition of tooth enamel is influenced by a complex intersect of environmental inputs, animal physiology, drinking behavior, and dietary intake. Here, the role of leaf water in determining the oxygen isotope ratios of sheep and goats are examined through carbon and oxygen isotope analyses of co-localized wild and domesticated sheep and goats grazing in the semi-arid environments of the Mongolian desert-steppe. Potential solutions that may help resolve mobility using oxygen isotopes are further explored through analyses of Pre-Pottery Neolithic B caprines paired with cattle from the mountainous environments of southern Jordan. Direct measurement of leaf water $\delta^{18}O$ values is also discussed and how this information, when coupled with oxygen isotopic information derived from livestock, in particular sheep and goats, with known-life histories can help decouple environmental inputs, physiology, and mobility in defining tooth enamel $\delta^{18}O$ values.

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Unlocking the dietary history of Late Pleistocene red deer individual from tooth enamel

Red deer (*Cervus elaphus*) teeth are abundant in Quaternary deposits in Britain and can be used to explore the palaeodietary ecology and physiology of the species, hence revealing evidence for seasonal patterns, diet and migration. Teeth are generally preferred to bones for chemical analysis and for microwear analysis, as their structure and chemical composition (particularly enamel) are more resistant to diagenetic alteration in post mortem environments and preserve a permanent record of tooth development through life, represented by incremental features. These features can be used to extract data regarding the life history of an individual. Here, trace element analysis has been employed for the first time on a red deer specimen with all permanent molars in situ, excavated from Late Pleistocene deposits at Tornewton Cave, Devon (Southwest England). The analysis was carried out using high resolution elemental intra-tooth profiles, of the enamel of each tooth via laser-ablation inductively-coupled plasma mass-spectrometry (LA-ICP-MS). Microwear analysis was also undertaken on the third molar to extract properties of the food consumed by the animal during its final weeks of life. The three molars provide complementary lines of evidence that together reveal the dietary history of the first 1.5 years of life of the individual. The m1 preserves the placental and nursing signals, whereas from the m2, it is possible to discern the effect of the weaning signal. The m3 is the only tooth unaffected by the weaning signal and reveals a sinusoidal signal that is here interpreted as reflecting seasonal dietary changes.

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Creating an experimental reference collection to study domestic ovine herds' diet based on dental microwear

A project leaded by the Catalan Institute of Classical Archaeology (ICAC) and the Catalan Institute of Human Paleoecology and Social Evolution (IPHES), allowed the creation of a reference collection for the study of dental microwear for domestic ovine herds. The aim is to build a modern reference of dental wear patterns resulting from different diets to compare with archaeological samples. This will permit to infer the variables in diet which determine the patterns of the dental microwear observed on the enamel of the ovine molars from archaeological sites. To obtain this reference collection we performed an experimental program with the collaboration of the '*Servei de Granges*' of the Autonomous University of Barcelona, where 35 sheep (*Ovis aries*) were split into five groups and fed with different kinds of vegetation potentially used by historical societies: alfalfa, ray-grass, forage, barley and a last group where soil particles were added to the alfalfa. After 8 days of feeding on the same type of plants, the animals were slaughtered and the heads were cleaned and prepared to realize silicone moulds and epoxy casts from the upper and lower molars. The analysis of the enamel surface at the stereomicroscope allowed us to establish the relation between dental microwear patterns and the different types of food ingested by the sheep. Our results show that there is no significant difference between the different dietary groups on the basis of the numbers of scratches or pits. Differences were observed with other variables such as the presence of cross scratches, scratches width (i.e. fine or coarse scratches) and the presence of large pits and gouges.

Keywords: *Experimental archaeology, dental microwear, sheep feeding, reference collection*

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Behind deer teeth: A microwear and mesowear analysis of Panamanian pre-Columbian archaeological sites

The white tailed-deer (*Odocoileus virginianus*) –one of the largest mammals in Holocene America– was a primary resource for pre-Columbian communities in the wooded savannas of Panama for several millennia. The oldest remains refer to the late Preceramic, when people were already farming (i.e. Cerro Mangote, 5900-3020 cal yr BP). Deer bones, antlers and skins were used for tools and ornaments. The prominent role in the regional symbolism is evidenced by the frequent representation of these cervids on art objects in complex politicized societies (i.e. Sitio Sierra 2000-500 cal yr BP and Cerro Juan Díaz, 2300-500 cal yr BP). Human predation on a dwarf deer was reported at Pedro González Island at 6200-5600 cal yr BP. This island had approached their current configuration by the time the first human colonists arrived by sea. They stayed for four to six centuries. They were farmers who cultivated maize and root crops. It has been observed that deer preferred second-growth vegetation and they would have been favored by the disturbance of primary forest cover by the expansion of agricultural fields. The aim of this presentation is to bring new elements to test this hypothesis. To achieve this objective, we propose an integrated microwear and mesowear analysis of deer teeth of four Panamanian archeological sites from different chronologies –Cerro Mangote, Pedro Gonzalez, Sitio Sierra and Cerro Juan Díaz–. Mesowear analysis show that dwarf deer diet changed when humans arrived to the island, mesowear score is high at the beginning of human occupation and it decreases through time. On the other hand microwear analysis, indicate that the number of scratches does not present a high degree of variation. This result responds to the limited availability of resources into the island. In the case of the mainland sites, both mesowear and microwear indicate that

white-tailed deer was a browser. In these sites, the number of scratches shows a high variability, which could indicate that people hunted deer in different seasons or places.

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Ecological niches of Neanderthal ungulates preys in the Iberian Mediterranean region: Are there any variation through the latitudinal gradient?

The European Middle Paleolithic has been a period influenced by strong environmental oscillations that affected Neanderthal's prey's behavior. These oscillations are subject to several factors as latitudinal position among others, which modify the vegetation cover and fauna response to the new environmental framework. The objective of this study is to test how the latitudinal factor influenced *Cervus elaphus* and *Equus ferus* in four archaeological sites of the Iberian Mediterranean area. We use the non-destructive dental wear method (meso- and microwear), based on the assumption of changes in the resources consumed over time. Both are sensitive to dietary and seasonal changes, but also to latitudinal gradients. The tooth mesowear technique identifies dietary changes on a long timescale (month-year), and it focuses on the cumulative abrasion-attrition effects of feeding processes on the cusps height and relief. The microwear technique studies the last meal of an individual (and its ecological niche at the time of death). It analyses the microscopic marks produced on the molar surface by the abrasive particles present in the food. It is sensitive to short term fluctuations (hours-days). The results show that both reed deer and horse display homogenous dietary patterns through different latitudinal positions. A regular dietary pattern characterizes *Cervus elaphus*, which show a predominance of mixed feeder with some punctual variations towards browsing. *Equusferus* does not change its feeding behavior, showing a grazing signal. The data suggest that each taxa occupied the same ecological niche despite its latitudinal position in the Iberian Mediterranean region.

Keywords: *Diet, microwear, mesowear, feeding pattern*

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Bear in mind: The last diets of the cave bear (*Ursus spelaeus*) from the Late Pleistocene in the northeast of the Iberian Peninsula

The diet of the extinct European cave bear, *Ursus spelaeus*, has been widely debated. The aim is to reconstruct the feeding habits of the cave bear through dental microwear analyzing the dietary patterns in several Middle Paleolithic populations from caves located in Catalonia (Spain) that occupy different biotopes: Ermitons, Arbreda, Llenes, Toll, Crusanes and Teixoneres. The results from these populations will be compared with a reference collection that includes a wide diversity of extant ursids: *Ailuropoda melanoleuca*, *Helarctos malayanus*, *Melursus ursinus*, *Tremarctos ornatus*, *Ursus americanus*, *Ursus maritimus* and *Ursus thibetanus*. First, we will test the hypothesis that populations that lived in different habitats will have different dietary habits. Second, bearing in mind that microwear provides information about the diet that the animal had during the last days/weeks before dying, this type of studies can provide data of temporary resolution to address the possible causes of its extinction linked to its diet from another perspective.

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Estimating the age and season-at-death of ungulates from the analysis of archaeological dental cementum: Recent improvements and perspectives from the CemeNTAA project

The CemeNTAA project, funded by the French National Research Agency (ANR), is dedicated to the improvement of the dental cementum analytical techniques applied to archaeological teeth. In this communication, we will present the main results obtained from the microscopic analysis of several collections of modern teeth from various ungulate species of known date-at-death (reindeer, red deer, fallow deer, mouflon, chamois, sheep, goat, bison, cattle, etc.) and from the examination of a large sample of archaeological specimens dated from the Middle Palaeolithic to the late Holocene periods. Among other results, we developed new standardized procedures of observation and interpretation of the incremental structures; established reliable criteria for identifying optical and observer biases as assessed from the use of blind tests on modern teeth; created physical cementum library associated with an open access database of microscopic images and comments for data sharing; presented novel data on cementum microstructure and composition from new analytical tools such as synchrotron X-ray fluorescence and diffraction mapping; categorized and documented potential taphonomic cementum alterations and modifications which may impede or skewed the observations; proposed new protocols for making histological thin-sections according to a less destructive approach; provided new data about seasonality and animal resource procurement in various prehistoric contexts in southern France, Belgium, northern Spain and southern Argentina.

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Determination of the death season by dental cementum analysis of horses *Equus ferus* (Boddaert, 1785) from the Upper Paleolithic site Kostenki 14 (Markina gora) (Voronezh region, Russia)

The study of growth layers in dental cement is a well-established method of determining the season of death of mammals. The material for this study were the teeth of horses Equus ferus (Boddaert, 1785) from the cultural layer IVa of the multilayered Upper Paleolithic site Kostenki 14 (Markina gora) (Voronezh Region, Russia). In the layer IVa a large number of bone remains of horses were found. Until now, the question of whether these animals died at the same time or at different times remains open. 36 permanent buccal teeth belonging to 24 individuals were studied. Teeth have been studied in thin sections and polished sections under transmitted, reflected and polarized light. The analysis of growth layers in dental cement showed different seasons of horse death. Seventeen individuals died in the spring-summer period, seven - in the autumn-winter period. The results of the cement analysis support the hypothesis of the asynchronical death of horses, when animals could die from both natural causes and as a result of hunting for them by the ancient humans. This is consistent with earlier data obtained during the determination of bone remains.

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Chemical characterization of cattle dental cementum from Late Neolithic Jarlshof (Scotland, United Kingdom)

The Shetland Isles were settled by the mid-4th millennium BC and represent the outermost limit of the Neolithic expansion. Today, Shetland is treeless and domesticated animals have had a serious impact on the regeneration of the native woodland. The status of the coverage of native woodlands at the beginning of the Neolithic is a source of debate. Biomolecular analysis has the potential of excavated material to provide insights into foddering/pasture practices and land cover vegetation reconstruction. The identification of chemical compounds, such as lipids, from dental calculus and animal cementum extracted from archaeological tooth specimens is currently providing new insights into dietary composition. The simplest compounds of lipids form hydrocarbons, including alkanes which are mostly derived from epicuticular waxes of vascular higher plant leaves. Alkanes are resistant to biodegradation and provide a valuable molecular marker that characterizes the vegetal origins (e.g. shrubs, grasses, reeds) of preserved organic matter. Thus, it offers a new potential for directly identifying plant sources (for instance graze v. browse) used for fodder and pasture, and land cover vegetation in comparison to bulk measurements of carbon stable isotopes, which is largely limited to providing information on the photosynthetic pathway of the plants ingested by herbivores. Dental calculus is not common in ruminants but teeth have often thick deposits of dental cementum that accumulate during the animal's lifetime. Thus, it offers a new potential as a source for biomolecules that through compound-specific analysis can be used to directly identify plant sources (grasses, herbs, woody plants, aquatic plants) used for fodder and pasture. The combination of bulk and compound-specific stable isotope analysis provides first general information about birth, and pasture/fodder management while compound-specific analysis provide details at biomolecular scale of plant type as well as further information about pasture/fodder seasonality. Here, we present preliminary results of compound-specific analysis ($\delta^{13}C$) of plant n-alkanes recovered from dental cementum plus bulk carbon and oxygen ($\delta^{18}O$) isotopes from incrementally sampled cattle tooth enamel from Jarlshof, Shetland Isles in order to generate a detailed picture of the foddering practices of the first farming communities of the Shetland Isles and its impact on the vegetation at the time.

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POSTER PRESENTATIONS

Rare earth analysis applied to Columbian mammoths (Proboscidea, *Mammuthus columbi*) from Tocuila, México

Remains of Late Pleistocene mammals have been associated with possible anthropic activity in Tocuila, State of México, México. There, remains of bison (*Bison* sp.), horses (*Equus* cf. *conversidens*), camels (*Camelops hesternus*), large felids, hares (*Lepus* sp.), voles (*Microtus mexicanus*), and Columbian mammoths (*Mammuthus columbi*) have been discovered. For the mammoths, at least five individuals from different ages and sexes are represented, and it has been proposed that they were members of a single herd that died at the same time due to the presence of a volcanic lahar in which they were buried. Assuming that the composition of rare earth elements would be similar in the remains if they were contemporaneous or buried under similar physical conditions, we utilized rare earth analysis to test the mentioned hypothesis. Our results indicated the presence of two groups, one formed by one individual, and the other by a possible herd formed by at least the four remaining individuals, suggesting that Tocuila mammoths did not die at the same time, but at different moments, and that they may not necessarily represent a unique familial group.

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The usefulness and precision of computed tomography (CT) for *Canis lupus familiaris* dental morphometry – its application to a Mesolithic Iberian dog

To discriminate between dog and wolf in analyses involving ancient *Canis* remains, a large reference database for odontometric parameters is essential. To expand such database, the precision of measurements obtained through CT images was validated by assessing how similar those are with values obtained through calliper measurements on teeth from deceased extant dogs. The mesiodistal (MD) and vestibular palatine (VP) lengths of 22 canines and 23 fourth premolar maxillary teeth (PM4) were measured via calliper and CT. The technical error of measurement (TEM) was estimated for both approaches while differences, correlations, and agreement between methods were evaluated through non-parametric Wilcoxon, Spearman correlation and Bland-Altmann analysis. Our data revealed a small %TEM for both calliper and CT (0.35 - 3.29%). The Wilcoxon test found no statistically significant differences between the two methods for the canine tooth (caliper mean±SD: 9.30±2.37 mm and 5.83±1.64 mm; CT mean±SD: 9.20±2.24mm and 5.82±1.61 mm, for MD and VP, respectively), but significant differences were obtained for the PM4 MD (16,59±3,16 vs 16,64±3,17 mm, $p<0.01$) and VP (6,70±1,22 vs 6,62±1,21, $p<0.05$) with medium effect sizes (r=.44 & .31). A significant correlation was found for all measurements ($p<0.01$). Agreement between both techniques was found for the MD measurement in both teeth. Despite these ambiguous results, the difference between methods never exceeded 1 mm, which legitimizes the use of CT scans as a complement for direct dental measurements. Tomographic images provide reliable data for reference databases for *Canis lupus familiaris*. A CT scan of a Mesolithic dog whose direct teeth measurement was impaired by the presence of post-depositional concretion, was possible and allowed the collection of odontometric data.

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A new program with modern sheep "Ripollesa" breeds: Building microwear, stable isotopes and coprolites referents for the Iberian Peninsula

Today many archaeological research projects are interested in microwear and stable isotope analyses in faunal remains. These analytical approaches allow dealing with life-conditions and life-story traits of specimens analyzed, hence of a huge importance in archaeology, and zooarchaeology in particular, to reconstruct how animal resources were exploited and managed (i.e. from seasonal hunting dynamics to pastoral mobility ranges, among other questions). However, the interpretative base-frame were these studies rest is mainly based on analogies from ethological studies and/or current herding activities, not always covering the casuistic being studied. In the frame of the Project SUMA-R3 (ICAC-IPHES-ICRPC) we initiated an experimental program with modern sheep breeds. These works aim to build a strength corpus of data to studies mentioned above. In our program, all specimens have a medical record and life trajectory. During the duration of the program aspects related to diet and mobility of specimens have been monitored, providing different indoor and outdoor dietary patterns, from pastures to forage including mixtures scenarios. The set of sampled specimens include specimens controlled during the last days alive to specimens controlled during seasonal and annual periods. Sampling includes pastures, forages, ingested water and faeces, among others animal tissues. The results of our program will allow overcoming the current inherent limitations of the studies (i.e. microwear, stable isotopes, phytoliths, coprolites) in faunal remains and address in a great depth its final interpretation.

Keywords: *Sheep, microwear, stable isotopes, diet, coprolites*

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Session title:

The diversity of exploitation and ritual use of animals in ancient East Asia

Session abstract:

Several independent loci of origin of food productions emerged during the Holocene, two areas of Eurasia that happened to become the earliest centers of domestication: The Fertile Crescent and Yangzi and Yellow River Basins of China. Important crops and animals, such as rice, millet, soybean, pigs and probably dog were domesticated indigenously in early China, where claimed to be another independent center of agriculture. However, with the mass increase of the available faunal assemblages, zooarchaeological researches in East Asia especially in China had been experiencing a developing period since 1990's. Diversity of subsistence and animal exploitation patterns can be shown by case studies mainly from Neolithic and Bronze Age sites, as well as many special ritual usages.

East Asia is also the key area which connecting Central Asia, Southeast Asia and Austronesia. The possible movement and dispersal of human population during ancient times might also be traced by the changes or the presences of certain diet preference.

This session aims to present the diversified life ways of the vast east: hunting gathering and fishing, agriculture and also nomadic herding, as well as animal use in ritual activities, and try to find out the possible internal or external causes that might impact these temporal and spacial differences, including environmental and cultural factors.

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ORAL PRESENTATIONS

Faunal remains analysis of Majiabang site, Jiaxing County, Zhejiang Province

Majiabang Site is located on the lower reaches of Yangtze River. It belongs to late Majiabang cultural period (about 6000 years ago). There are 59104 excavated animal remains in 2009, including these authenticated species: crab, mussel, carp, crucian, chub, black carp, catfish, yellow-head catfish, weever, snakehead, turtle, trionyx sinensis, crocodile, bird, buffalo, elk, sika deer, river deer, muntjac, wild boar, domestic pig, dog, rabbit, diminutive canidae (fox?), diminutive mustelidae, etc.

Most of the excavated animals are wild creatures which contain a variety of species, indicating that there exist large-scale freshwater area and woodland around the site. Mammals take up the first place in all remains while fish, turtle, *trionyx sinensis* and bird occupy the second. Others are minorities. With the perspective of every period in the site, half of mammals' both general NISP and MNI are exceeded by deer which are considered as ancestors' main meat resource. They may feed domestic pig already, and also hunt the wild boar. Pigs had not high status in ancestors' meat resource. The reserved parts of main mammals show that ancestors have the ability to use the limbs and horns of large and medium mammals to a great extent to make kinds of tools and living utensils.

Keywords: *Majiabang site, Yangtze River, zooarchaeology, subsistence strategy*

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The animal utilization and livestock raising strategy in late Neolithic Age along the middle Huai River- a case study of Houjiazhai site

Huai River drainage area, as transitional between the Yangtze and Yellow River, has been the pass way of southern and northern culture as well as the district of mixed agriculture of millet and rice. The analysis integrating zooarchaeological and stable isotopic methods on animal bones from Houjiazhai site, a Neolithic site in middle Huai River, sketched a picture of animal exploitation and livestock management at that time. Pigs were domesticated but not predominant in human protein when hunting and fishing were equally important, or more than equal. No statistical difference concerning stable isotopic values between domestic pigs and wild boars was detected, thus people at Houjiazhai site were supposed to raise pigs in free-range manner. This was established under lower pressure for livestock when hunting and fishing had supplied an amount of animal protein. Besides, rice cultivation was at the early stage and low yield. Thus, pigs were allowed to forage in surrounding environment instead of being provided with hey by humans.

The synthesis of zooarchaeological and stable isotopic analysis at several sites clarified chronological trends of animal utilization and pig feeding strategy along different reaches of Huai River. In upper stream, pigs were being domesticated at Jiahu site about 9000 years ago in free-range manner. Pig domestication developed rapidly with percentages increased and M3 size decreased quickly. This paralleled with growing human population and expanded millet cultivation. Cases in middle and lower Huai River were quite different. Although pig domestication was inferred to begin at Shunshanji site as early as 8500 years ago, it did not make big progress in subsequent periods. The percentages of pigs had barely overwhelmed 60% excluding Wanbei site while hunting and fishing were important protein sources. Pigs were managed in free-range, sharing similar food with their wild counterparts. But it is still unsolved if pig feeding strategy altered as more and more millets being planted in this area.

Keywords: *Huai River, Neolithic Age, zooarchaeology, stable isotope, livestock husbandry*

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Wetland exploitation in the Central Plain: Zooarchaeological perspectives

From late Neolithic period, population increased greatly in the Central Plain in China. According to archaeological and paleo-environmental research, the Longshan sites are usually allocated on platforms in the middle of wetlands, to avoid flood while being close enough to water and food resources.

This paper focus on the study of animal remains from Pingliangtai and Haojiatai, two Longshan sites which were excavated in 2016. Animal remains were collected carefully from sieving. Apart from domesticated species such as dog and pig, wild animal including Milu deer, water deer, sika deer, water buffalo, carp, and catfish are identified from the assemblage, indicating the exploitation of wetland. In addition, sites in the adjacent areas, e.g. the famous Jiahu, also show clear evidence of wetland exploitation. Therefore, wetland exploitation plays an important part in the Neolithic subsistence, for hunting and fishing, like the sites in this paper, and for rice farming, represented by the lower Yangtze River region.

Keywords: *Wetland exploitation, Central Plain, Longshan*

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Animal use in Guandimiao: A case study of a village site in the Chinese Bronze Age (ca. 1250–1100 BCE)

The site of Guandimiao is located to the southwest of modern Guandimiao village, in Xingyang county of Henan province, China. The remaining area is estimated to around 100,000 m^2. The site was discovered and excavated as part of salvage excavations that took place across a large region to make way for the Yangtze River diversion mega-project. The field work, which was conducted by Henan Provincial Institute of Cultural Heritage and Archaeology, lasted three years (2006.7–2008.8) and covered an area of over 20,000 m^2. This is the only well preserved and fully excavated village site in Bronze Age to date, primarily dating to the Anyang period (ca. 1250–1100 BCE). A large animal assemblage has been recovered from trash and/or sacrificial pits, kilns, wells, residential structures, and burials.

Domestic animals, especially livestock, have dominated the whole collection, with quite few wild species are present. Cattle and pigs were the main meat resources, and dogs, caprine, and deer were also necessary supplement. A number of fragments unearthed from pits show various cut and chop marks, which may be related to the activities of animal slaughtering and multi-step butchering. Whole cattle were most commonly found in the sacrificial pits, while some whole pigs and sheep were also discovered in such sacrificial context. Dog sacrifices were seen in most of the burials. A number of uninscribed oracle-bones, comprised mainly of cattle scapulars, as well as a few cattle/horse pelvises and turtle shells, were also revealed in Guandimiao. Thus, it is clear that divination also happened in this small village. To sum up, animal remains in Guandimiao provides important information for investigating the relationship between humans and animals in the Shang rural areas.

Keywords: *Guandimiao, Shang dynasty, Anyang period, animal remains, oracle bone*

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Beyond oracle bones: What else can turtles from archaeological sites in China tell us about the ancient past?

The earliest widely known socio-cultural connections between societies in China and turtles date back to the sacrificial remains from Jiahu (6500-5500 B.C.E.). Later, but perhaps better known because of their association with the origins of Chinese writing, turtles used as oracle bones are an important component of archaeological remains from the late Shang Dynasty site of Anyang (1350-1046 B.C.E.). That being said, turtle remains from other archaeological sites all over China demonstrate a presence of turtles beyond ritual contexts since the early Neolithic. Unfortunately, apart from a few studies at both Jiahu and Anyang, there is a dearth of in-depth analysis of the roles turtles played in the cultural developmental history of China. This constitutes a considerable impediment to our understanding of the anthropogenic processes on changes in turtle ecology and how this in turn affected human societies. In this paper, we use the archaeofaunal collections from four archaeological sites in Anhui and Guangdong provinces to demonstrate the application of new and existing methodologies to the study of turtles including taxonomic and elemental identification, quantification, the reconstruction of caloric and nutritional values, taphonomy, and anthropogenic modifications. The results are then analyzed together with other archaeofaunal materials, including mammals and fish, and discussed in the context of the archaeology of the sites. We argue that the results can provide datasets to help formulate new research questions related to ancient subsistence strategies and economies, seasonality of human activities and site occupation, cultural utilization of natural resources, and anthropogenic activities on animal ecology.

Keywords: *Turtles, Anhui Province, Guangdong Province, ritual and non-ritual contexts*

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The intercultural exchange of horse sacrifice in the agricultural-pastoral contact zone during the Spring and Autumn Period and the Warring States Period, China

Among the six livestock (cattle, horse, sheep, pig, dog and chicken) in ancient China, horse was the last to be domesticated. However, as soon as horses were domesticated, they took up a major role in Chinese social and economic systems in aspects such as military, ritual, power and trade. In the Dynastic agrarian states in China, as horse production systems began to develop, the scale of horse sacrifice increased. As seen during the Spring and Autumn period and the Warring States period, large horse sacrificial pits emerged in various states such as Qin, Chu and Qi. In these agrarian states, it was a principle to sacrifice the entire horse, together with chariots. On the other hand, another horse sacrificial ritual was observed in the northern grasslands during the same period. In a pastoral culture subsisting on stock faming in the northern grasslands, horses were sacrificed with cattle, sheep and dogs. The ritual practice was to sacrifice the heads and the hooves of the animals in graves. During this period, in the region where cultures subsisting on different modes of production came into contact and interacted, different types of horse sacrifice emerged, fusing with the locally existing animal ritual practices. In this presentation, I will discuss the background of a newly observed horse sacrifice in the agricultural-pastoral contact zone during the Spring and Autumn period and the Warring States period.

Keywords: *Horse sacrifice, China, the Spring and Autumn Period and the Warring States Period, the agricultural-pastoral contact zone*

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The ancient horse ritual in Japan

There is no clear evidence that any wild horses existed in the Neolithic Age in the Japanese Archipelago, but archaeological data indicates that domesticated horses were introduced from the Korean Peninsula with the breeding system as early as in the 5th century during the Kofun Period. The formation of the political civilization began, and the introduction of the domesticated horse had an important meaning in some societies and polities, as horses were used as a symbol of political or military power.

This presentation will introduce the evidence of horse burial and ritual at the settlement sites and examine the features of early horse utilization in Japanese societies. It has been insisted that the horse burial accompanied by the tomb of the chief was famous, but archaeological excavations have recently identified the horse burial and ritual in the settlement sites in the Kawachi(Osaka) and Yamato(Nara) areas which were the center of the sovereignty in the 5th century. According to the earliest Japanese chronicle known as “Nihon shoki”, ancient people bred horses in the areas. In Kawachi, there are the identified burials which consists of the complete horse skeleton and part of cranial. There are more cases findings of the cranial burial than the whole body burial in Japan. In Yamato, there are not only whole skeletons but also butchered bones after the ritual. These styles in such a settlement is considered to be a habit of the early horse keepers.

Keywords: *Horse, ritual, Japan*

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Session Title:

Paleoecology of the Quaternary using microvertebrate records

Session abstract:

This half-day session, hosted by the Microvertebrate Working Group (MVWG), is designed to highlight the important contribution of microvertebrate records to our understanding of Quaternary paleoecology. The long history of paleoenvironmental and paleoclimatic research utilizing small mammal, reptile, and amphibian material recovered from Pleistocene-Holocene archaeological sites attests to the usefulness of these records in furthering our understanding of past human environments. Many characteristics of microvertebrate assemblages have been identified which facilitate the construction of precise and fine-scaled paleoenvironmental reconstructions, including the ubiquity of the material in cave sites, the small home ranges, affinity with certain microhabitats, and diversity of the taxa recovered, and the ecological input of the accumulating predator. Podium presentations detailing recent or on-going paleoecological studies from any geographic region are welcome, and those utilizing new or cutting-edge methodological techniques are encouraged. Poster contributions may be considered if interest exceeds the number of podium spots. Although this session is hosted by the MVWG, participation by both MVWG members and interested non-members is encouraged.

Organisers:

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Sara E. Rhodes, Eberhard-Karls-Universität Tübingen. sara.rhodes@uni-tuebingen.de,

Keynote speech:

Western Mediterranean environment and climate during the late Quaternary using small-mammal assemblages

Juan Manuel López-García, ICREA-IPHES, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain. jmlopez@iphes.cat

ORAL PRESENTATIONS

Investigating the paleoecological context of the earliest hominin settlement in Western Europe using small vertebrates

In the last decade, new paleontological and archeological evidence has challenged previous views on the early human settlement of Europe. In particular, the Georgian site of Dmanisi, which dates back to the Early Pleistocene (some 1.8 million years ago) has provided significant data on the physical characteristics of these first hominids to emerge from Africa. A second area of interest is centered in Spain, where the first evidence of early human settlement in Western Europe is present in the Guadix-Baza Basin (Orce region, southern Spain) dating to 1.2–1.4 Ma. Given the importance of these discoveries, every effort is being made to reconstruct the landscapes where these hominins once thrived. Pluri and cross-disciplinarity has been a key for the interpretation of such sites crossing the results coming from the study of large mammals, small mammals, amphibians and reptiles, fishes, pollen analyses, numerical dates, etc. that permit to yield a scenario for the paleoclimatic and paleoenvironmental conditions that were in place at the time of the first hominin occurrence in Western Europe.

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Climatic and environmental impact of Pleistocene-Holocene transition in southern Caspian Sea: Study of microfaunal remains from Ali-Tappeh cave, Iran

Caspian south-east seashore is currently characterized by a humid plain rimed by sea in the North and Albroz mountains in the south, which isolate this region from the rest of the Iranian Plateau. It is located at the crossroad between Iran, Turkmenistan, and considered as a biodiversity hotspot because of it specific environment and climatic conditions. Palaeoenvironmental and archaeological history of this region during the Pleistocene-Holocene transition is documented by four different archaeological sites, Hotu and Belt Caves excavated in 1949 and 1951 respectively, Ali Tappeh excavated in 1963 and Komishan excavated in 2003 and 2009. All these sites show very heterogeneous faunal assemblages characteristic of both steppic (*Gazelles, Saiga tatarica, Equus hemiones, Spermophilus fulvus*) and more forested environments (*Sus scrofa, Cervus elaphus, Bos primigenius*). Moreover, the impact of Caspian Sea fluctuations, known thanks to specific geological features, is also visible in faunal records with an important number of sea birds and seals during periods of high sea level. But so far no study focused on microfaunal remains recovered in those excavations except a recent ongoing work on spermophiles. The present work aims to compare the evolution of both large and small mammals' communities from Ali Tappeh in order to precise climatic and environmental changes during Pleistocene-Holocene transition. Taxonomic and taphonomic studies were carried out in order

to determine the assemblage's origin, and palaeoenvironmental reconstructions were performed using indices such as the Habitat Weighting, the Taxonomic Habitat Index and correspondence analyses.

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Of Mice and (Neanderthal) Men: A taxonomic and taphonomic analysis of the small mammal assemblages from Hohle Fels and Geißenklösterle caves in the Ach Valley, Germany

The study of small mammal remains as paleoenvironmental indicators has a long tradition in German prehistoric research. Building upon this history, we present here the results of our taphonomic and taxonomic analysis of the small mammal assemblages from the Middle Paleolithic and Aurignacian at Geißenklösterle and Hohle Fels caves. This period is of particular interest as it spans the de-population of the region by Neanderthal groups, followed by a short time during which the sites were unoccupied, and the arrival of Anatomically Modern Humans with a complex toolkit and fully developed modern artistic and musical traditions. We use three forms of taphonomic modification to determine the accumulators active at the sites and assess their effect on the taxonomic composition of the assemblages. These include skeletal element representation, breakage, digestive corrosion. A total of 21 taxa were identified and their combined paleoenvironmental signal assessed using the Indicator species and Habitat weighing methods. Both assemblages are dominated by five vole species and two lemmings, however the overall ecological signals reflect the known climatic oscillations characteristic of the Central European Late Pleistocene. These results are then compared to the sedimentary, botanical, and faunal records from the two sites to produce a detailed diachronic climatic signal for the Ach Valley which can be utilized to further interpretations of settlement dynamics and organization in the region at both an intra- and inter-site scale.

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A weighted Averaging Partial Least Squares model for paleoenvironmental reconstruction: A case study from Upper Paleolithic Manot Cave, Israel

Micromammalian faunas are a key proxy in paleoenvironmental reconstruction, but their use as reliable and fine-tuned indicators of ancient environments is challenged by issues of taphonomy and assumptions of species' habitat preferences. Specifically, there is ambiguity in drawing paleoecological inferences from species which presently occur across multiple habitat types and from species assemblages representing species with contradicting habitat requirements.

We used 78 recent micromammalian assemblages of five owls (Strigidae) to determine an ecological baseline for paleoenvironmental reconstruction, examining quantitative and statistical interactions (Bayesian and generalized linear models) among prey taxa along aridity and vegetation gradients in Mediterranean Israel. We also used these data in training a machine learning model to reconstruct vegetation density from taxonomic abundances. Finally, we applied the model to micromammal assemblages from the Upper Paleolithic of Manot Cave (33-49 kya). Our findings show that species

composition was significantly related to both owl species and the environment. Although many of the recent owl assemblages contain species with different habitat requirements, the machine-learning model differentiated accurately and consistently between maquis and more sparsely vegetated habitats.

Günther's voles dominated all occupation phases of Manot's, leading the model to indicate that open habitats were generally widespread. However, the persistent yet rare occurrence of forest dwellers such as field mice (*Apodemus*), Caucasian squirrels (*Sciurus anomalus*) and forest dormice (*Dryomys nitedula*) suggests that maquis was also present in the vicinity of the cave. Manot also includes the region's first fossil record of the Eurasian snow vole (*Chionomys nivalis*), suggesting cooler conditions than today.

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Studies of modern and archaeological microvertebrates in the Ongamira Valley: Taphonomy, taxonomy, paleoenvironmental conditions and models of human occupation in the north of the Córdoba provence (Central Argentina)

The studies of microvertebrates in archaeological contexts with different physiognomies refer to a long tradition throughout the world, and a substantial development in the last three decades of zooarchaeological research in Argentina. The province of Córdoba has analysis of this kind of sets, although the productions are meager and are limited almost entirely to the understanding of sets of small vertebrates as a complement to human diet. Nevertheless, the presence of microvertebrates in archaeological sites can be attributed to a variety of causes, including natural ones, such as the regurgitation of microvertebrates consumed by various predators. Determining the origin of these remains is therefore of great importance to our understanding of site formation processes. In addition, the detailed study of these remains can provide complementary data on such topics as the composition of biocenoses, palaeoenvironments and the seasonality of deposits. In this study, we analyzed modern sets of regurgitated pellets (n=240) of the barn owl (*Tyto alba*: Tytonidae) from the Alero Deodoro Roca site (ADR), Ongamira, Córdoba, Argentina. We compared the results with those from archaeological microvertebrates (NISP=700) from excavations at ADR, La Gruta and PNO1 dating to the Late Holocene (ca. 1900–3600 years BP). Most of the archaeological assemblages show the same composition as those of the modern pellets produced by Strigiformes. However, we observed variation in the representation of taxa, reflecting environmental changes over time. Using current temperature and humidity data to compare the assemblages, we observed that some results could be related to Holocenic climatic variations, already described by other studies. Furthermore, this research suggests that Strigiformes may occupy the rockshelters in Autumn-Winter, at which time the site (ADR) would not have been occupied so intensely by human populations.

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Post-glacial recolonization of Europe by *Microtus arvalis* – Evidence from ancient DNA

Analyses of ancient DNA have proven to be one of the most effective approaches to investigate evolutionary history of species. So far most of the attention goes to the large mammals while studies of small mammals remains underrepresented. Here we used ancient DNA to investigate post-glacial recolonization of Europe and in particular the impact of Younger Dryas cooling on common voles' (*Microtus arvalis*) populations. Genetic diversity of the contemporary common voles suggests that populations of this species may have survived cold episodes, like Last Glacial Maximum, not only in traditional Mediterranean glacial refugia, but also at higher latitudes. Central France, Alpine region and especially Carpathians were indicated as a possible northern refugia for this species. Recent studies of Late Pleistocene faunas showed that Younger Dryas cooling affected populations of many mammalian species leading to extinctions or population replacements. However, analyses of the contemporary genetic diversity were not able to trace any impact of YD on common vole populations.

We analysed mtDNA cytochrome b sequences obtained from more than 50 *Microtus arvalis* specimens from multiple paleontological sites across Europe. On one hand we found a discontinuity in Late Glacial and Holocene populations in the Carpathian area while on the other there was continuity in populations from Northern Spain. This suggests different impact of YD on common vole populations across Europe. From the local extinctions and population replacements in some parts to virtually no effects in the others.

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The tortoise, hare, mole rate, and legless lizard: A contextual approach to testing the broad spectrum hypothesis in the south Levantine Natufian culture

The Natufian culture in the Levant (15,000–11,600 years BP) has great importance as a transitional phase between the Paleolithic and Neolithic periods. Resource intensification and expansion of diet breadth to include a wider variety of game species, often referred to as the Broad-spectrum Revolution (BSR), are prominent topics in Natufian zooarchaeology. However, a major methodological shortcoming in testing BSR hypotheses involves lack of integration among studies of medium-large and small potential prey taxa. We adopt a detailed contextual approach to this issue.

In research on the Natufian culture small taxa, including micro-mammals, reptiles and amphibians are usually excluded from human subsistence studies, and regarded mostly as natural accumulations due to non-human predator activity. Yet, previous work has shown a sharp increase in mole rat and squamate (lizards and snakes) remains in the Natufian, compared to preceding periods of the final Pleistocene, which may suggest that they played a role in the expansion of the diet breadth. The inclusion of these taxa in BSR research is problematic due to potential quantification biases when awarding equal dietary weight to standard specimen counts of macro and micro-remains.

The current research focuses on the Natufian site of el-Wad Terrace, Mount Carmel, Israel, combining new taphonomic and contextual analysis of reptile remains with previous data on macro- and micro-

mammals. Our approach considers within-site variation in frequencies and distribution of these taxonomic groups in relation to different contexts (e.g., domestic and external living floors, non-domestic deposits), thereby better controlling the differences in accumulation rates of different-size taxa. This allows us to fine-tune approximations of the BSR in the Early Natufian of the site.

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Big vs. small: New evidence on human site use and preservation bias from Tabun Cave Fauna (layer C; middle Middle Paleolithic), Mount Carmel, Israel

A major challenge in the prehistory of cave sites involves the complex interactions between natural and cultural processes of deposition and the compounding effects of post-depositional processes. Integrating data from different size categories and taxonomic groups of fauna can considerably aid towards clarifying these complicated issues.

Layer C of Tabun Cave from A. Jelinke's excavation (ca. 165 Ky BP) revealed a unique, highly dynamic micro-stratigraphic sequence with abundant microvertebrate fauna, but relatively few remains of large fauna. Newly analyzed samples of the microvertebrate assemblage, comprising >1,000 specimens from a major part of the Layer C sequence of sub-layers (n = 12), show the presence of digestion marks and indicate the contribution of raptors to assemblage formation. In contrast, macrofaunal remains evidence clear signs of human butchering including hammerstone percussion and burn marks. Vertical change in frequencies of these two types of fauna is examined in detail.

Sub-layers with dense microvertebrate remains and only few macrofaunal remains could represent long phases of human abandonment in the sequence. However, this interpretation is seemingly challenged by the widespread occurrence of burned microvertebrate remains. In an attempt to clarify these complexities, and implications for long-term variation in human site-use behavior and intensity, we combine information on varying densities across sub-layers for different faunal find categories with additional data on lithic densities and geoarchaeological analysis. Preliminary findings point to a scenario where the lower sub-layers represent more intense human presence, possibly replaced by a lengthy period of more short-term stays but still with intensive use of fire.

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Session title:

Understanding cattle-human interactions: Interdisciplinary approaches to an ancient relationship

Session abstract:

Humans have an ancient relationship with cattle. The aurochs (*Bos primigenius*) was regularly hunted by prehistoric societies, and the domesticated form (*Bos taurus*), along with sheep (*Ovis aries*), goat (*Capra hircus*) and pig (*Sus domesticus*), has been one of the most important livestock species for the last 10,000 years. Zooarchaeological studies allow us to determine how important cattle were in the diet and economy of human populations and when and where cattle were domesticated and improved, and this is just the tip of the iceberg… Scientific innovations have led to the adoption of powerful research tools, for example, stable isotopes have enabled us to investigate animal diets and geographical origins, and ancient DNA allows to trace domestication events and to depict phenotypic traits of past animals. Additionally, historical texts and representations of cattle in art and literature can enhance zooarchaeological interpretations of cattle-human interactions.

This session aims to bring together zooarchaeologists and their collaborators in other scientific fields investigating our relationship with cattle from prehistory to modern times. We welcome interdisciplinary contributions which combine zooarchaeological information with further scientific, ethnographic, philosophical or archival studies. Potential themes for inclusion are:

- Early human cattle interactions: ancient depictions and hunting economies
- Cattle domestication: new perspectives
- Stock improvement and selective cattle breeding: where, how and why?
- Cattle mobility and human migration
- Cattle, the state and the individual: how have states and their ideologies shaped cattle husbandry and how can we study this archaeologically?
- Cattle in religion, ritual, literature and art
- Cattle biodiversity: the past, the present and the debate around resurrecting the aurochs

Organisers:

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ORAL PRESENTATIONS

Near Eastern ancient genomics and insights into cattle prehistory

The genetic origins of domestic ungulates have been explored for over two decades by extrapolating patterns from modern genomes. This has had some success, for example in identifying highly divergent eastern and western genomes that are consistent with separate origins in cattle. However, patterns which are observable today result from multiply overlaid processes of migration, admixture, population fluctuations and selection which it can prove impossible to parse, especially within restricted geographical regions such as the Near East. Indeed, the last few years of investigation of ancient human genetic diversity in Europe has taught us that the genetic past can only be reliably modelled through directly accessing ancient genome variation. Despite the challenge of working with DNA-depleted bones typical of warmer climates, we have built a collection of Near Eastern genome data in cattle by directed sampling of petrous bones and high throughput sequencing. This talk will focus on emerging ancient cattle data and how this adds inference about the nature and geography of recruitment from the wild. The contributions from collaborating investigators will be acknowledged within the talk.

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Comparing Neolithic cattle kill-off patterns in Anatolia, Eastern and Northwestern Europe; a contribution to the study of dairying

In this paper, we present demographic profiles for cattle exploitation resulting from several Neolithic sites in the northwest Anatolia, east Bulgaria, and the Netherlands, in order to track the emergence of dairy production in these localities. An integrated high resolution kill-off pattern analysis together with stable isotope analysis (Carbon, Oxygen and Nitrogen) on tooth remains are targeted in this comparative approach to understand herding strategies in various environmental and cultural settings.

Our talk will focus on the presentation of the material, contexts and the first results on each of the four sites of Fikirtepe and Yenikapı (6400-5800 BC) in Anatolia, Dzuljunica-Smardeš (6050-5550 calBC) in Bulgaria, and Schipluiden (3630-3380 calBC) in the Netherlands.

Keywords: *Kill-off patterns, milk, Anatolia, Bulgaria, The Netherlands*

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The genetic diversity of the southwest Asian aurochs and its evolution during domestication

Archeozoological evidence points to the Urfa region of Anatolia as the locality where the first aurochs had been domesticated during the PPNB, but this evidence is scarce. Genetic data from present-day population give support to this hypothesis but are subject to limitations with respect to inference about past events since the characterization of the past diversity, of extinct lineages and population replacements is beyond reach. For this reason, we used a paleogenetic and paleogenomic approaches to study the genetic diversity of the aurochs in Anatolia at the beginning of the Neolithic and followed its evolution over time in wild and domestic cattle in Anatolia and Europe. The obtained genetic data shed light on the population structure of the aurochs, which then allowed us to deduce the key elements of the domestication process from the Neolithic to the Bronze Age performed by people belonging to different cultures. Our study also yielded important insights into the various modalities of the spread of domestic cattle into Europe and Africa.

Keywords: *Bos, phylogeography, phylogeny, paleogenomics, ancient DNA, domestication*

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Cattle for the ancestors at Neolithic Çatalhöyük, Turkey

The recent ontological turn in anthropological theory has opened a space for relational approaches in zooarchaeology, in which boundaries between animals and humans are permeable and persons can take non-human forms. Here I explore cattle-human relations in the Near Eastern Neolithic, focusing on Çatalhöyük in central Anatolia. I argue that the relationship between humans and wild cattle at Çatalhöyük was intense, with aurochs hunting a powerfully performative experience followed by feasting. There are many parallels in the treatment of dead humans and aurochsen. Both humans and cattle parts are buried beneath house floors, in complementary spatial positions, incorporating both into the houses (which have their own life cycle) as ancestors. The Near Eastern Neolithic is characterized by a widespread concern with heads and heedlessness; both human and animal heads are sometimes removed and used, displayed, and deposited, as well as depicted. Cattle heads and horns are especially prominent in these contexts.

Central Anatolians resisted the adoption of domestic cattle for several centuries, while they accepted the herding of sheep and goats. I suggest this reluctance derives from the particularly close relationship between cattle and humans evident at Çatalhöyük. When small numbers of domestic cattle appear in the later levels of the site, wild cattle display initially intensify. These domestic cattle may signal a change in human kinship patterns now marked with bridewealth, perhaps eroding the endogamous marriage system at Çatalhöyük and contributing to the eventual dispersal of its inhabitants.

Keywords: *Near East, Anatolia, relationality, kinship, bridewealth*
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Cow milk exploitation and calf weaning in the Early Neolithic Balkans: Insights from intra-tooth variations in nitrogen isotope ratios

Human interdependence with domestic cattle (*Bos taurus*) in the North-Central Balkans can be traced to the origins of animal husbandry in the region, i.e. to the Early Neolithic (c. 6000-5400 cal. BC). The prevalence of cattle remains in the archaeozoological record and the ubiquity of bovid imagery are testimonies to their prominent role in the economic and symbolic sphere, as well as in their day-to-day interactions with humans. Furthermore, recent lipid analyses of organic residues from Early Neolithic pottery vessels from a number of Balkan sites (Ethier et al. 2017) indicate that dairying was not only present from the start, but also fairly widespread. However, cow milk exploitation would not have been straightforward, but heavily dependent on the length of lactation, the presence/absence of suckling calves, the amount left for human consumption and consequently on the calf weaning pattern. In this paper, following Balasse & Tresset (2002), we examine the weaning patterns in several individuals from Early Neolithic sites (Starcevo-Grad, Topole-Bac, Magareci mlin) by looking into the intra-tooth (M1, M2) variation in nitrogen isotope (?15N) ratios of dentine collagen. Observed trophic changes related to different dietary stages (in utero, suckling and weaning) are cross-referenced with herd age structures, in order to make inferences about slaughter patterns. An emphasis on animal life-histories, by means of stable isotope analyses and ageing, provide new insights into the nature of early cattle husbandry, milk availability and sharing between humans and calves, as well as the management of animals in these processes.

Keywords: *Early Neolithic Balkans, cattle milk exploitation, weaning, nitrogen isotope ratios, dentine collagen*

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Multi-disciplinary perspectives on Linearbandkeramik cattle and their primary and secondary product exploitation

The farmers and stockherders of early Neolithic cultures in central and northwestern Europe were instrumental in the introduction and spread of cattle-based agriculture in this region. This initial phase was crucial in establishing cattle-based agricultural systems that proceeded them, which caused a revolutionary shift in human subsistence strategy that reshaped prehistoric European culture, biology and economy and underlie modern life worldwide. Previous investigations into cattle husbandry in the Linearbandkeramik (LBK) and associated cultures have been hampered by taphonomic/poor preservation conditions, and as a result have often been limited to site-specific or regional perspectives. The ERC NeoMilk (Evershed, FP7-IDEAS-ERC/324202) project has generated a wealth of new data for early Neolithic cattle husbandry in central Europe using complementary multi-proxy approaches on a much wider scale than has previously been possible. Here we present a synthesis of the results from this multidisciplinary research project that include detailed organic residue analyses of pottery for primary and secondary product processing, archaeozoological investigation of mortality profiles and bone fat exploitation coupled with innovative statistical approaches, as well as incremental stable isotopic and compound-specific analysis of cattle teeth. Our research indicates that cattle husbandry practices were similar across the LBK cultural zone with regional differences. The use of these animals for their primary and secondary products varied regionally, with more intensive dairying in some regions offset by more intensive bone marrow processing in others. Stable isotopic analysis provides evidence of the regional variation in the use of forest for pasture and the provision of leafy fodder during winter periods. The overall nuanced picture of LBK cattle husbandry highlights the critical importance of this domesticate in shaping the diets, economies and wider biological/evolutionary impacts of the early Neolithic communities of central and northern Europe, the legacy of which can be seen in Europe today.

Keywords: *Milk, husbandry practices, Neolithic, multi-proxy, NeoMilk, central and northern Europe*

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Modelling the arrival and spread of domesticated cattle into Neolithic Britain

The most recent chronological modelling of the British Neolithic demonstrates that the pottery, monuments, new forms of stone tools and domesticates first appear in the south-east around 4050BC. Whilst new Bayesian modelling of the British Neolithic (Whittle et al. 2011), gives a chronological framework for the period, it still leaves an important question regarding the mechanisms by which Neolithic things, practises, people and animals reached Britain. This is a much debated topic and could be summarised as extensive colonisation and migration from the continent, as advocated by Alison Sheridan (2010); or adoption of Neolithic ways by the native people of Britain, as argued by Thomas (2013). It is against this background that this paper considers one aspect of the debate, the arrival and spread of domestic animals, primarily cattle. To do this we start with the question "How many cows do you need to start the British Neolithic?"

To answer such a question, we draw on zoological research regarding viable genetic populations, fecundity and survival rates, along with archaeological evidence for boat transportation. This information is used to develop a series of Monte Carlo cattle population simulations, in conjunction with Neolithic Chronological modelling. The resulting models suggest a very small number of cattle and other domestic animals need ever have been imported to Britain.

References:

Sheridan, A. 2010. The Neolithization of Britain and Ireland: the 'big picture', in B. Finlayson & G. Warren (eds) Landscapes in transition: 89-105. Oxford: Oxbow.

Thomas, J. 2013. The birth of Neolithic Britain: an interpretive account. Oxford: Oxford University Press.

Keywords: *Cattle, British, population models, Early Neolithic*

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Mobility of cattle herds in the Late Neolithic: A case study from southern Britain

The Late Neolithic (mid 3rd millennium BC) site of Durrington Walls (Wiltshire, southern Britain) consists of a large 'henge' with many associated features, built on top of an extensive village. The site was excavated in the 1960s and 2000s and has produced one of the largest animal bone assemblages from prehistoric Europe. The faunal remains represent the result of domestic and, especially, ceremonial activities (Craig et al. 2015). They are dominated by pig bones, with cattle the second most represented species (Albarella & Serjeantson 2002). Strontium isotopic analysis of cattle teeth initially revealed that the herds originated from many different geographic areas, some substantially distant from the site (Viner et al. 2010). This is in contrast with pottery and flint production that are largely local (Chan et al. 2016). In this paper we will discuss more recent work on a much larger sample, which has allowed us to provide better resolution to the previously identified pattern. The results have been integrated with an analysis of Oxygen isotopes and, in combination, confirm the highly diverse origins of the cattle from Durrington Walls. They suggest that, though many different geographic areas are involved, there is a predominance of animals coming from the north and west of the country. A smaller proportion of cattle are consistent with a local origin. The isotopic results are also compared with a morphometric analysis of the cattle remains. The overall evidence indicates that Durrington Walls was the focus of large seasonal gatherings of people, in which cattle played a central role.

Keywords: *Cattle, Neolithic, Britain, mobility, teeth*

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A multidisciplinary approach to cattle management strategies in the Iberian Peninsula: understanding selective signatures and cattle use in cave sites during middle Neolithic

The adoption of cattle in the western Mediterranean area is attested during the Neolithic period, being represented in 30% of the Early Neolithic sites in the Iberian Peninsula. This species is documented in nearly all the mainland, although its exploitation is more intense in the northern area and in the Ebro valley.

The representation frequencies of *Bos taurus* show a large degree of variability during 5500-3500 cal BC, with a tendency to increase over time. Regarding the modes of appropriation of this species, there is currently no context available that allows the transition from wild to domestic to be retraced.

With regard to cattle management and modes of exploitation, these are highly differentiated. Available data suggest their exploitation for meat, dairy products and labour force. Taking this variability into account, a multidisciplinary approach has been applied in order to characterize and understand cattle management strategies developed in key archaeological sites during the middle Neolithic in the Iberian Peninsula.

We present in this communication the results of an integrated analysis of cattle including traditional biometry, stable isotope analysis, biomechanical data obtained through cross-sections and 3D geometric morphometrics and paleopathological analyses. We aim with this study to redefine our understanding of cattle early management strategies and bring forth developed techniques that may help us to acquire a better comprehension of human-cattle evolving relationships.

Keywords: *Cattle domestication, cattle use, Neolithic, Iberian Peninsula, multidisciplinary approach*

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Bovid (cattle and yak) riding and traction in Mongolia and interior Eurasia

One of the oldest domesticated animals is cattle (*B. taurus*), but the ways cattle and yak (*B. grunniens*) were used by ancient people differ remarkably between regions and time periods. Across all periods, the meat and skin of the cattle and yak were especially important, while in Mongolia and much of Asia, transport was historically significant. Cattle and yak transport appears to have been particularly important before horse domestication, and even following its domestication in high mountain areas. This paper seeks to explain the role of the cattle and yak in ancient societies by discussing archaeological and Mongolian ethnographic evidence. Petroglyphs, cattle remains, and cart fragments have been found from Mongolian Eneolithic and Early Bronze Age archaeological sites, and support rich ethnographic evidence of cattle, yak, and khainag (Dzo or hybrid between yak and cattle) transport into the modern era. This evidence points to the development of cattle and cattle pastoralism in the region during the 3rd millennia in the Altai and Khangai Mountains and raises the possibility that early herders used cattle and yak for riding and carts. This tradition might have played an important role in the shift to horse riding and chariots during the Middle and Late Bronze Age

Keywords: *Cattle, yak, pastoralism, transport, Mongolia*

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The aurochs deposit from the Chalcolithic ditched enclosure of Camino de las Yeseras (Madrid, Spain)

The site of Camino de Las Yeseras is a 22 ha. large Chalcolithic ditched enclosure located 15 km NE of Madrid city. Its strategic location close to natural communication routes, agriculture and pasture land, flint, clay, salt resources etc., indicates that it was probably a central place, starting at the end of the 4th-millennium cal BC but the main structures belong to the whole 3rd-millennium cal. BCE. More than 8500 structures have been documented in a surface scraping and ca.1400 has been excavated. The architecture is very complex with almost five concentric ditched enclosures, several huts, collective and individual burials with Bell Beaker and non-Bell Beaker grave goods and thousands of pits.

Especially relevant are several faunal deposits in pits, graves, and ditches that suggest a complex symbolic relationship of the inhabitants with some wild and domestic animals. In this communication, the archaeological context of one of these pits with a large aurochs skull is presented. The skull from a huge male was placed over a small wedged clay platform in the center of the pit. The filling surrounding the cranium was sediment with hundreds of pottery sherds, mainly bowls of low to medium capacity, lithic tools, faunal remains and some other symbolic items that, with the taphonomical study of this context, are reflecting a unique event of a sealing act. Bovines play, in the subsistence and symbolic sphere of Camino de las Yeseras, a relevant role for the Chalcolithic communities in central Iberia.

Keywords: *Chalcolithic, Central Iberia, ritual deposit*

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The emergence and intensification of cattle traction in China

Cattle traction provides a key source of animal-powered labor in agricultural societies around the world. In China, diverse lines of evidence, including archaeological material culture, iconographic evidence, historical documents, and the ethnographic record, show a clear history of the continuous use of cattle labour throughout Chinese dynastic periods starting at least at the Han dynasty (202 BC-AD 220). Here, bone pathology data recovered from cattle dating to the second millennium BC – which encompasses the Chinese Bronze Age period – is examined in order to more closely document the evolution and intensification of cattle traction. The coincidence in terms of the appearance time between cattle traction and the staple crop of wheat in China may indicate they were closely related when first introduced into China from the Near East, which provides another perspective for our understanding of the ancient trans-Eurasian movements.

Keywords: *China; the Bronze Age; cattle traction; bone pathology*

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Initiation and intensification of cattle husbandry in the southern Levant

Cattle have been fundamental features of southern Levantine and other SW Asian agrarian economies since the Neolithic. Over this span of time, cattle have served as sources of meat and milk, figured into the ritual life of prehistoric communities, represented wealth in Bronze Age societies, and, as agents of traction, labored as the engines of pre-industrial agriculture. However, the earliest forms of cattle management in the southern Levant remain poorly defined. The initial intensification of cattle exploitation was underway during the tenth millennium cal. BC, but much ambiguity surrounds processes involving the emergence and evolution of cattle husbandry in the region. For example, previous research has described incipient cattle husbandry in the southern Levant as a process involving i) autochthonous domestication of indigenous aurochsen, ii) a 'prey pathway' where overhunting promoted close management, iii) failed attempts to manage aurochsen, and iv) the transmission and uptake of domesticates from the northern Levant.

Here, we re-examine the timing and intensification of cattle management in the southern Levant through analyses of important new biometrical and demographic data sets from PPNA and PPNB sites located east of the Jordan Valley, and re-analyses of previously published data sets. We incorporate these into the existing corpus of data for the southern Levant spanning the Natufian to the Early Bronze Age. Using multiple zooarchaeological proxies (LSI, fusion timings and tooth wear) together with up-to-date statistical techniques such mixture modeling and Bayesian analyses, we demonstrate a more complex picture of early cattle management and subsequent intensification of cattle husbandry systems in the southern Levant.

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Interactions between human and cattle during the Early Iron Age in Anuradhapura, Sri Lanka

The Anuradhapura Citadel excavations provide the archaeozoological evidence of cattle appearing around 900 BC. Two major cultural phases can be identified through the human activities like butchering and cut marks on the bones. About domestic animals, cattle were the major group of domestic animals (24%) in the assemblage. The metrical analyses comprised the identification of breed type as well as withers' height. According to the age estimation of the bones, the highest

number of cattle (over 86%) belonged to the adult animals that reveal the evidence of maximum usage the animal resources. Concerning the interpretation of secondary data, the earliest literary sources consist of several incidences on cowherds and herds of cattle appeared in the above period. The chronicles and inscriptions cited the taboo of beef in the later period of Anuradhapura. Further, the data furnished some information on the social status and the economy of the inhabitants. Similarly, artistic representation, namely stone sculptures often depicts humped cattle in a number of places. Evidently, the cattle species were a small size that were apparently, comparable with a similar type of species occurred in the Peninsular India. Concerning human and animal relationships, it can be concluded the presence of evidence of food economy, agricultural activities, cultural contact with India and its religious influence.

Keywords: *Animal-resources, metrical analyses, age estimation, interpretation*

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Size of cattle as a proxy of the social and economic environment

The changes that occurred in size and morphology of cattle have been described in the archaeozoological literature for various prehistoric and historical periods in different regions. Several publications deal with size changes during a rather brief transition from one period to another due to, for instance, the influence of a changing political and economic environment. Much less information is, however, available for size changes over a longer time span within a specific region.

In this presentation the variation of cattle size on a local scale is presented using an analysis of metrical data from several prehistoric and historical sites in Southwest Anatolia. The data are covering a time span of more than 6000 years, ranging from the Neolithic to the Byzantine period. The osteometrical study is based on the Logarithmic Size Index (LSI) method, using a large set of measurements. The data are combined with mixture analysis which allows to reconstruct the sex ratio of the slaughtered cattle. All results are discussed considering other available information on subsistence strategies, such as livestock composition and slaughter ages of the animals, as well as the contemporaneous social and economic context.

Keywords: *Cattle, LSI, sex ratio, Southwest Anatolia*

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The late Roman to early Anglo-Saxon transition in Britain: The evidence from cattle husbandry

The collapse of the Roman world-system in the 5th century AD implied major political, socio-cultural, and economic changes in the territories of the former Empire and beyond. Animal remains are very well-placed to inform on such developments, due to the importance of specialised food production and distribution practices within the Roman Empire, and to the very different strategies of food provision that characterised early post-Roman Europe. This paper focusses on changes in cattle husbandry during the late Roman-early Anglo-Saxon transition in Britain; this species played a key role in the Roman economy and maintained its importance in the early post-Roman period, alongside the other main domestic animals. In particular, biometrical analyses are employed to assess the fate of Roman improved cattle types, which appeared in these regions as the Empire expanded northwards. The results reveal a size reduction during the early Anglo-Saxon period; this is interpreted in light of the different role and scale of cattle exploitation, and contextualised within the changing political and socio-economic conditions of north-west Europe. Changes in cattle exploitation are also revealed by culling profiles, that suggest a greater focus on meat and dairy products in the early Anglo-Saxon period while, for Roman times, ageing data highlight the importance of cattle in agricultural works. Finally, different approaches to carcass processing have been detected for the two periods; such differences do not only reflect the contrasting scales and objectives of food production, but also reveal the presence of distinctive butchery traditions.

Keywords: *Cattle husbandry, biometry, butchery, late Roman-early Anglo-Saxon transition, Britain*

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Cattle improvement in the cities of Roman Lusitania

Previous data gathered by our team showed little changes in cattle size in Portugal before the 15th century AD. In Roman times, the province of Lusitania comprised the southwestern part of the Iberian Peninsula (present-day central and southern Portugal and Spanish Extremadura). Several new Lusitanian cities, with no anterior occupation, were built and had important developments during Roman times (e.g. present-day Mérida and Ammaia, among others). Lisbon (Olissipo), was also a very relevant city in Roman times, but its human occupation started in pre-historic times.

We analyse osteometric data from cattle recovered in excavations in these cities and compare with results from smaller towns and other periods. The data reveal slight signs of cattle improvement, mainly in the new Roman cities. Measurements of cattle bones from the main Roman cities suggest that this species increased in size during the Roman occupation.

Innovations were probably implemented through new breed importation or new breeding strategies. DNA preliminary results show continuity through time in maternal lineages, favouring the hypothesis of local breeding.

Keywords: *Cattle, animal improvement, Roman Period, Lusitania*

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An archaeogenetical study of cattle bones from 17th century Carnide, Lisbon, Portugal

Inheritable traits of cattle were modified in various ways at different times by diverse cultures. A large collection of 17th century cattle remains excavated from 71 silos in the Largo do Coreto in Carnide, Lisbon, included 47 complete and 44 distal metacarpals. These provide an opportunity to make a detailed osteometrical and archaeogenetical study. While morphological changes such as size increase, as detected in bone measurements, indicate improvement for larger animals, ancient DNA is useful for studying evolutionary trajectories and modes of improvement of domestic animals. High-throughput sequencing can show evolutionary processes at unprecedented resolution. In a comprehensive osteometrical study of cattle size variation in southern Portugal from Iron Age to post-Medieval times including 17th century Carnide, we noted a substantial increase of size between Moslem and Christian times – i.e., following the re-conquest between 13th and 15th centuries AD. We concluded that Carnide cattle were probably generalist animals that could also have been selected for meat (i.e. heavier carcasses). We then generated whole-genome data for 12 Carnide specimens on the Illumina HiSeqX platform with mean coverages ranging between 0.01 x and 0.04 x. Mitochondrial genome coverages were between 3x and 28 x. We shall discuss these data which indicate specific biological properties, including the sex and coat colour of these animals. We shall also analyze the variability of genes linked to body size and meat traits. We will further investigate the genetic relationship between Carnide cattle and extant Iberian breeds, and test the maternal genetic continuity since Moslem times.

Keywords: *Improvement, Iberian cattle, ancient DNA, archaeogenetics, osteometry*

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POSTER PRESENTATIONS

Economic change and agricultural identity in Iron Age and Roman Europe: The case of cattle breeding in Britain.

Changes in cattle morphology represent a striking indicator of economic and culturally-induced movements that occurred in Western Europe between the Iron Age and the Roman period. The intensification and expansion of supply networks, as well as changes in production systems and targets, led to the emergence of new animal selection criteria. However, the mechanisms through which this agricultural evolution spread across the Roman Empire are still unclear. Romanisation resulted in an increased diversity of animal morphotypes and, presumably, greater specialisation in forms of exploitation. We see this at both the macro- and micro-regional scale, but some of this differentiation is still very difficult to pinpoint, both in its nature and scale.

Britain, due to its geographic position at the edge of the Empire, represents a valuable case study to investigate livestock trade and development. It provides the opportunity to explore the interaction between sites and territories, as well as the development of a global market and the diffusion of new economic trends. Examples of cultural resistance can also potentially be documented. By studying changes and diversity in the skeletal morphology of cattle in this peripheral area and comparing results with previous analyses carried out in the Gallic, Germanic and Italian provinces, parallel evolutions of different economic models can be reconstructed. This study intends to represent a step towards an understanding of a geography of livestock breeding, animal production strategies and meat supply networks in the Roman period.

Keywords: *Cattle, Britain, Iron Age, Roman, morphometry*

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Food for thought: An investigation into South Shields as a major supply base in North-East England during the 3rd century AD.

This study focuses on the Roman fort of South Shields during the 3rd century AD, when it was converted into a prominent supply base for the Roman army stationed in northern England. A sample assemblage from Period 6B (mid- to late-3rd century AD) was analysed for both general frequencies of the species present and specific element frequencies to determine diet during this period. Tooth wear analysis was conducted to determine age range for one of the main domesticates (cattle), while a metric analysis was conducted to determine if one or more cattle populations were being sourced for meat by the soldiers at South Shields. Strontium isotope analysis was conducted on the M3 teeth of six cattle from South Shields to determine their potential geographic origins within Britain. The results of the analysis indicate that the faunal remains at South Shields reflect the overall dietary pattern of Roman soldiers in Britain during the 3rd century AD, with the three main domesticates (cattle, sheep and pig) making up the majority of the species consumed. The combined results of the tooth wear and metric analyses on the cattle remains indicate that there was more than one population being exploited at South Shields, with the local community potentially supplying cattle killed at the ages of 1-3 years (as a result of annual culling) and 8-10 years (with individuals who had previously been exploited for secondary purposes). Out of the six individuals chosen for strontium isotope analysis, all between 8-10 years of age, only two had 87Sr/86Sr values which indicate local origins, while the remaining four had 87Sr/86Sr values indicating they originated from either the Lake District area (approximately 150km away) or Galloway Forest Park (approximately 200km away). The two M3 teeth with local 87Sr/86Sr values were also the largest, which could be an indication of different breeds of cattle being imported into northern England during the 3rd century AD, via the international port at South Shields.

Keywords: *Cattle, Roman army, diet, strontium*

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Session title:

Excuse me, there is a hare in my soup! Taphonomic studies on small vertebrates

Session abstract:

Taphonomic studies are traditionally focused on the identification of anthropic or non-anthropic faunal accumulations in archaeological sites. Most of these analyses address hominin and early AMH abilities to acquire and exploit large vertebrates. However, new excavation techniques and methodologies on Palaeolithic sites resulted in the recovery of small vertebrates, such as lagomorphs, tortoises, birds or aquatic resources (i.e. turtles, fish and marine mammals). The inclusion of such taxa in the archaeological record can be accidental or linked to hominin or other predators' activity. Likewise, in geographic areas, where larger vertebrates do not occur before the introduction of domestic species, smaller size animals could have been part of the main nutritional resources available for hominin consumption.

This session tackles the role played by small vertebrates within hominin subsistence practices through taphonomic analysis. It welcomes contributions addressing the study of lagomorphs, tortoises, birds and aquatic vertebrate remains in order to identify the most effective taphonomic indicators for the separation of the different possible agents of bone accumulation within the archaeological record. Communications on neo-taphonomic experiments comparing and contrasting taphonomic issues on large and small vertebrates are also encouraged.

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Keynote speech:

Looking at the small picture: How does the taphonomy of small vertebrates complement the research on human subsistence practices and lifestyle?

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ORAL PRESENTATIONS

Tortoise soup: Staple or supplement food in the Portuguese Middle Palaeolithic

Optimal foraging theory and diet breadth models often place ungulates and other large mammals in a high ranking position due to their high-energy return that is closely dependant on the animals' caloric value and handling costs (eg. Winterhalder & Smith 2000, Dusseldorp 2010). However, such practice has been heavily challenged archaeologically (eg. Blasco et al 2016, Cochard et al 2012, Thompson & Henshilwood 2014) and ethnographically (eg. Mehaan 1983; Siegfried & Hockey 1985). Moreover, mass collection of small prey can result in return rates comparable to large game (Madsen & Schmitt 1998), and dietary diversity is considered to be nutritionally beneficial on its own right (Hockett & Haws 2003, 2009).

A growing body of evidence has been recovered from several sites in the Mediterranean Basin confirming Neanderthal use of small size prey (eg. Blasco & Fernández 2009, 2012a,b; Nabais 2012; Stiner 2005). Tortoises have been playing a significant role in the discussion since meticulous taphonomic analyses have been demonstrating their collection and consumption by hominins. In Iberia there are several Neanderthal sites with tortoise assemblages (Morales & Sanchis 2009), but it is often difficult to appreciate their contribution within the diet since it is rarely discussed if they were used as a staple or supplement food.

In Portugal, the two-key Middle Palaeolithic caves of Oliveira and Figueira Brava are the only sites where detailed taphonomic analyses were performed, confirming hominin use of tortoises. Despite their slow moving characteristics – consequently making tortoises an easy prey to catch –, their contribution to the diet seems to vary. Gruta da Oliveira, with a more inland position, supports a tendency towards mass collection and thus impacting severely on the local tortoise population. However, Gruta da Figueira Brava points towards a propensity of opportunistic collections upon encounter, maybe due to the availability of more varied resources typical of coastal sites.

Keywords: *Tortoise, Middle Palaeolithic, coastal resources*

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Marsupial manipulators: Preliminary taphonomic signatures for the Tasmanian devil (*Sarcophilus harrisii*) and further analysis of the spotted-tailed quoll (*Dasyuris maculatus*)

Faunal assemblages in Australian archaeological sites can be characterised by high levels of fragmentation. There has been ongoing debate over whether this fragmentation is the result of human or carnivore behaviours. The prevalence of marsupial carnivores in the Australian record means that current taphonomic data, which have generally focussed on placental carnivores, are not sufficient to answer this question. The dingo (Canis lupus dingo) was the first placental carnivore introduced to Australia, and only arrived approximately 4,000 years ago. Studies into the taphonomic impact of marsupial carnivores on bone have been limited and do not provide enough information for confidence in the attribution of fragmented Australian faunal assemblages. However, humans have shared both shelters and prey species with modern marsupial carnivores, including the Tasmanian devil (Sarcophilus harrisii), the spotted-tailed quoll (Dasyuris maculatus), and potentially the Tasmanian tiger (Thylacinus cynocephalus). This study builds on previous work to determine taphonomic signatures for S. harrisii and D. maculatus through the use of actualistic feeding trials and examination of resulting prey remains, including in scats. Trials included a range of prey species, varying in size from quails (average weight of approximately 100 grams) to Bennett's wallabies (average weight for males of approximately 20 kilograms). This allowed the comparison of taphonomic markings from a single carnivore on a variety of prey sizes. Further work will help to solidify these signatures and aims to demonstrate whether they can be effectively applied to existing archaeological assemblages.

Keywords: *Sarcophilus harrisii; taphonomy; osteophage; dasyurid; marsupial carnivore*

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Experimental results with an untested small carnivore, the Honey Badger (*Mellivora capensis*)

A substantial body of research has developed in recent years investigating carnivore and bird modifications of rabbit and similar sized prey. These studies have proved highly valuable in European and New World sites, however their applicability in an African context has been poorly investigated. Additionally, African small carnivores are badly understudied in the taphonomic literature. The honey badger is a widespread, opportunistic carnivore, with high potential as a bone accumulator especially in cave settings. This paper presents, to the best of our knowledge, the first attempt to test bone modification patterns in this carnivore. Domestic rabbit (Oryctolagus cunniculus) carcasses where fed experimentally to a breeding pair of captive honey badgers housed at the Johannesburg Zoo. Bones from the feeding refuse and the scats were analysed. The honey badgers preferentially opened their prey at the belly and focused their feeding on nutritionally high yield soft parts, often discarding low yield parts like distal appendages, crania, and skins. Bones from the scat assemblage, on the other hand, displayed very high fragmentation, with light digestive modification. Tooth marking on bones from the scats was phenomenally high, but mark dimensions were exceptionally small. This study shows the value in using experimental methods to close gaps in our knowledge of carnivore taphonomy and emphasises how little we understand the potential role of African small carnivores in modern and fossil ecosystems.

Keywords: *Carnivore, actualistic study, ratel, leporid, archaeology*

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The land of plenty: Culinary privileges of smelters at the Copper Age pile-dwelling site of Stare gmajne (Slovenia)

Stare gmajne is a pile dwelling site located on Ljubljansko barje (central Slovenia), which is widely known by the discovery of a well preserved wooden wheel with axle attached. It was occupied twice during the 34th and 32nd century BC, as clearly shown by dendrochronological data. On the margins of the village a small area was identified as the local smelting “centre” due to the find of fragments of several moulds, with some of them bearing traces of copper. Metal workers were much admired in the communities of the time due to their know-how. On top of that, when a complex ore was used, the metal processing was accompanied by toxic gases that suffocated the smelter, leading to lameness, muscular atrophy, loss if reflexes and, ultimately, premature death.

But how did their privileged social role manifest? Insights into this topic are gained by discussing the peculiar and very interesting assemblages of both archaeological and archaeobiological finds from the mentioned micro-area. Great stress is given to faunal remains, supposedly representing food waste. The assemblage is characterized by a strikingly high share of birds, turtles and amphibians, which makes it clearly distinct from the large-mammal-dominated material gathered in the central part of the settlement. Additional insights were obtained by in-depth taphonomic analysis, assessments of season of culling/hunting, the analysis of the presence/absence of medullary bones in birds etc.

Keywords: *Copper Age, smelters, tortoises, birds, amphibians*

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General Session:

Medieval Europe and Americas

ORAL PRESENTATIONS

Birds in Medieval Norway

The modern Norwegian avifauna is well-studied, but little work has been done on past avifaunas within Norway and much of Scandinavia. Here, we report on avian assemblages of Medieval (1000-1500AD) urban and rural sites across Norway. Avian assemblages from urban sites are dominated by domesticated species such as Gallus gallus and Anser anser, often forming 75% of the avian assemblage. Wild species are present as well, with wild Galliformes and Accipiter species being most common. The opposite is true of rural sites whereby wild species are dominant. Rural sites are defined by a lack of diversity in avian species; often a specific species is being singled out, with inland rural sites targeting wild Galliformes such as Lagopus (Vesle Hjerkin) and coastal or island sites exploiting seabirds (Røst). Seabirds, corvids and pigeons, all of which are prevalent today, rarely appear in Medieval Norwegian assemblages. In addition, few passerines have been identified within the material, which we interpret as a recovery bias. Urban sites are showing the first evidence for cockfighting in Scandinavia, likely brought in via trading networks, and a variety of Gallus gallus breeds. The emerging pattern suggests that domestic species were heavily relied upon for subsistence on urban sites, whilst wild fowl and hawks represented a social importance. In contrast, rural sites targeted the most abundant species available and were likely seasonal hunting grounds.

Keywords: *Scandinavia, Middle Ages, avifauna, cockfighting, Gallus.*

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Insights on Mudéjar diet in Medieval Lisbon, Portugal (12–14th centuries): Data from Mouraria

We present the study of the fauna from Largo da Severa, located in the Mouraria neighbourhood of Lisbon, from the 12th–14th centuries (post-Christian Conquest). This is one of the very few Mudéjar contexts that provides data regarding their diet. Its inhabitants ate almost exclusively domesticated mammals: caprines (mostly sheep) and cattle. As a complement, they also consumed rabbit, chicken, fish and molluscs. These marine animals show that such resources were regularly eaten, though their real importance remains uncertain. Pork was very rare. Non-edible animals, like dog and donkey, were also identified. Stable isotope analysis of carbon and nitrogen was conducted on 22 faunal samples including chicken, cattle, sheep, goat, dog, pig and seabream. The results indicate a very homogenous diet for all the domestic species, with the exception of one dog that shows a diet based on high trophic level proteins. All herbivores and omnivores consumed C3 plants, although carbon values vary between –21.6‰ and –18.4‰. The nitrogen values are also rather homogenous, ranging between 3.8‰ and 7.9‰. No species-related diet can be identified in either herbivores or omnivores, suggesting that husbandry practices were similar for the livestock accessed by the Mudéjar community. These results are striking when compared to the wide range of values found for materials from Lisbon between Roman and late Middle Age. This is likely to be related to the spatial, legal and identity segregation of the inhabitants of the Moorish neighbourhood, which implies severe rules and the existence of community-only institutions and food-related establishments.

Keywords: *Portugal, Medieval, Mudéjar, diet*

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Two cesspits from late and post-medieval Brussels (Belgium): What do they tell us?

Cesspits are commonly encountered on medieval archaeological sites and often yield a wealth of information on past diet, waste disposal strategies, health and hygiene. Indeed, cesspits were used not only to collect ordure, but also to dump discarded household items (ceramics, glass, wooden objects), food refuse, etc., during or after the use of the cesspit. In general, their fills allow to illustrate daily life at the site, and more specifically, the organisation and procurement of the inhabitant's food supply. Two cesspits, one dating to the 14th/15th century and the other to the beginning of the 16th century, were excavated in the centre of Brussels and contained several layers of well-preserved organic deposits. The entire content of the pits was collected for archaeozoological, macrobotanical, palynological, and palaeoparasitological analyses. The fills of the Brussels structures seemed to consist almost exclusively of ordure. Some individual coprolites were also recorded and studied separately. Ceramics and other archaeological objects were very rare. The sieved residues exist largely of small fruit pips and small bones, mainly of fish but also of songbirds, chicken and a large quantity of tiny unidentifiable bone fragments, all affected by digestive processes. Macrobotanical analyses revealed a large variety of plant foods, while pollen analysis even enlarged this spectrum. Densities and species composition of the faunal remains varied considerably both between and within the layers. Considering these various aspects, two questions were raised: 1) What can these two cesspits really tell us about the human diet of a late and post-medieval household in Brussels? 2) How does sampling of the cesspit fillings and the selection of subsamples retained for analysis affect the results?

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Domestication and consumption of camelids during the Middle Holocene in the Puna of Salta, Argentina: Osteometrical and zooarchaeological contributions from the Alero Cuevas and Abrigo Pozo Cavado sites

The camelids are the main animal resource for the subsistence of human populations in the highlands of the South Central Andes from the beginning of the first occupations during the transition Pleistocene - Holocene to the present. The archaeological studies carried out in the region indicate the existence of consumption of different taxa but with predominance in the camelids, showing a specialization and domestication along the time. This work analyzes and discusses the osteometric variability in camelids observed during the Middle Holocene (around 8,000 - 3,500 BP years) in the Puna of Salta, Argentina. The most relevant changes were related to processes of intensification and domestication. Based on osteometric analyzes, the results show the variability that emerged as a result of domestication of camelids during the Middle Holocene. For this, three statistical methods are used: multivariate, bivariate and univariate. The results of these studies suggest a high level of osteometric variability in camelids and an observable increase in the size of certain specimens from the Middle Holocene, in the context of macro-regional processes of domestication.

Keywords: *Camelids, Puna, Middle Holocene, osteometrical analysis, domestication*

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Felines in Xochicalco, an epiclassic site of Mesoamerica, discussing the biocultural diversity

The jaguar (Panthera onca) is the predominant species of feline that is associated with various ritual values in Mesoamerican societies, such as the Olmecs, Mexicas, Mayas, Zapotecs and Mixtecs, among others. However, this is not the case of the archaeological site of Xochicalco, declared a World Heritage Site (UNESCO) that is located in the State of Morelos (Mexico), where a diversity of felines was recorded. Xochicalco has a period of main occupation between 700 and 900 C. E., and it was an important city-state on the military, urban and ceremonial issues, and a relative similarity with other contemporary cultural settlements, such as El Tajín, Veracruz; Cholula, Puebla and Cacaxtla, Tlaxcala. In the last twenty years, archaeological research has been intensified, including archaeozoological studies, where vertebrates comprising fish, reptiles, birds and mammals have been identified. In this site the remains of felines were identified: the jaguar (Panthera onca), the puma (Puma concolor) and the American lynx (Lynx rufus), with various cultural modifications and also there are representations in slabs carved and sculptures of at least two of these organisms. Where the puma is the most predominant species in bone remains and depictions, with a high biocultural importance. The work discusses the methodological challenges to identify the different species of felines in each of the types of records, as well as to discuss the possible captivity and management of this group, for its use by the inhabitants of this Mesoamerican locality.

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Modelling past distributions of North American turkeys (*Meleagris* sp.)

AbstractThe so-called animal domestication in the Americas is an issue with new proxies, these shows an intense relationship between human and a great diversity of animals with many management strategies. In North and Middle America inhabits the endemic phasianid of the genus Meleagris, with two species: the wild or northern turkey (M. gallopavo), culturally the most known species with a natural distribution from Central North America to Central Mexico; and the ocellated turkey (M. ocellata), endemic of the Yucatán peninsula. However, the cultural exchange of both species starts with the early sedentary societies, then the natural distributions of both species in central and south México were not known clearly. This work proposes a model of geographical distribution of both species based on the ecological niche breadth, it is defined as the range or variety of conditions delimiting a species' niche, such as: temperature, climate, variety of foods, and the diversity of habitats, where a species could inhabit. This concept allows us to understand biological adaptations. Its recent applications include the adaptation of biogeographical shift ranges in response to climate changes. Based on current temperature and precipitation data, some models of past geographic distributions of the two species of genus Meleagris and for M. gallopavo subspecies were made. The results show the influence of climatic variables for each taxon and their current potential distribution, mainly into the late Pleistocene. The main inferences are: 1) in the late Pleistocene both species of Meleagris had a reduction and drastic changes in their geographical distribution, then we can look for the speciation events previous to this period and; 2) The subspecies M. g. gallopavo had an extensive niche breadth that includes the niches of all the other taxa, then the diversification of populations is a product of climatic changes from the late Pleistocene onward, and was one component for the domestication process in America.

Keywords: *Wild turkey, Meleagris, ecological niche breadth, archaeobiogeography, adaptation*

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5000 years of deposition of large mammals and megamammals at the end of the Pleistocene at Ultima Esperanza, Chile

A few hundred years after the retreat of the Pleistocene glaciers the remains of large mammals and megamammals began to be deposited at some of the caves of Cerro Benitez, Ultima Esperanza, Chile. The oldest records are for Lama gracilis and Mylodon, and by ca. 13,000 BP different taxa were widely recorded, including Mylodon, camelids, Hippidion saldiasi and extinct carnivores. Some of the caves are dark chambers used as carnivore dens, but exogenous caves and rockshelters are also characterized by rich bone assemblages. These faunas were exposed to the increasing cold spell of the Antarctic Cold Reversal, the explosive eruption of the Reclús Volcano ca. 12,600 BP, the progressive advance of the Nothofagus forest and finally -between 11,000-10,000 BP- the interaction with humans. This presentation will discuss the different factors contributing to the differential representation of taxa.

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El Puerto Rock shelter: An approach to the hunter gatherer way of life in a semiarid area from a faunal assemblage (Hurtado valley, IV Region, Chile)

In the semiarid región of Chile we have found evidence of early hunter gatherer groups, which would have lived mainly by hunting camelids. This issue takes relevance on a context where we see different dynamics between coast and the foothills that are next to the Andes cordillera (Troncoso et al. 2016). All of this it is observed on a social complexity scenario that has been identified for dates between 4000 and 2000 yrs B.P. For the foothill areas, 80km east from the coast, there has been a generalization regarding the hunt of camelids (mainly Lama guanicoe), where smaller species, have been almost forgotten as posible diet complement. In this way, it seems that the relationship between hunters and their enviroment was more important than we thought. Apparently they had vast knowledge of the enviroment and the resources it could provide. On this context and within the framework of the project FONDECYT 1150776, we present the analysis of the bone assemblage from El Puerto rock shelter, which provides important information to get a closer look to the relationship between hunter gatherers and their enviroment. Given the remains of camelids and other small species, such as rodents, marsupials, reptiles and birds, the analysis became much more complex, especially when we observe that small animals could be either complementing the diet or behaving as taphonomic agents. Thus, understanding what happens in this site is a good entry to comprehend the way of life of this kind of groups, so later we can contrast them with surrounding contexts, allowing us to get a more complete and detailed understanding of the organization of hunter gatherers of the foothill areas.

References:

Troncoso, A., et al. (2016). Dinámica espacial y temporal de las ocupaciones prehispánicas en la cuenca hidrográfica del río Limarí (30° Lat. S.). Chungara, Revista Chilena de Antropología Chilena. http://dx.doi.org/10.4067/S0717-73562016005000016.

Keywords: *Hunter gatherers, camelids, diet, social complexity*

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Town versus Country foodways and social status at Britain's Smyrnéa settlement, Florida, North America, 1766-1777

Established by Dr. Andrew Turnbull, a Scottish physician and entrepreneur, the Smyrnéa settlement was an agricultural enterprise that existed from 1776 to 1777 during the British occupation of Florida. The settlement was divided into the "Country" (indentured farmers' houses and agricultural fields) and the "Town" (barracks/ workshops/warehouses/dwellings for clerks/specialists). Among the architectural remains were four domestic structures: a "country" and a "town" house and outdoor oven. Analysis of faunal samples from these structures show that domestic meats contributed more substantially to the overall diet of the town inhabitants whereas the country farmers depended more heavily upon locally available fish and wild game. The zooarchaeological evidence thus seems to indicate that the town residents had greater access to British meat supplies and were most likely of higher social status that those living in the country.

Keywords: *Domestic structures, domestic meats, fish/wild game, social status, British Colonial Florida*

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Pride and precariousness: A historical zooarchaeological examination of the dynamics of colonial ıdentities in New Mexico

Deep contestations of essentialized identity categories are a contemporary reality for communities for whom cultural patrimony of land and water resources plays a crucial role. Yet, archaeology has long been wanting in how our discipline has been able to recognize the dynamics of the changing nature of identity practices which shaped interactions between groups of people, particularly in areas with a sustained colonial presence and resource-challenged ecologies. The project area of Northern New Mexico (USA) is situated temporally between the mid-18th to early 20th centuries, a period of great social and political dynamism in the area. During this period, the region experienced fluctuations of influence among several polities: including between Spain, Plains and Pueblo tribes and nations, and later the United States. From early colonial entanglements, "Genizaro" emerged as a status designation referring to former captives from a range of Native American heritages and their descendants. Scholars disagree as to whether Genizaro communities and persons should be dealt with analytically as members of an emergent ethno-racial identity or to rely instead on socio-economic status related to property ownership. I use zooarchaeological evidence from multiple domestic Indo-Hispano sites coupled with historical documentary research to argue that "Genizaro" was indeed a culturally dynamic and meaningful identity category up to the present day. Archaeologically, we see evidence both of culturally-defined food choice and the economic hardships of marginalized communities. Documentary research demonstrates how the language and logic of animal husbandry and other sciences was deployed to naturalize racist mentalities applicable to Genizaro Indians.

Keywords: *Identity, colonialism, historical archaeology*

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POSTER PRESENTATIONS

Archaezoology of Early Medieval strongholds in Bohemia (the Czech Republic)

The contribution offers a selective overview of the archaeozoological record from the early medieval strongholds in the territory of Bohemia connected with the Premyslid dynasty. A summary analysis of the osteological data connecting with the strongholds dated back to the origin of the early Czech state from 9th to 12th century have never been presented. Our aim is to pick out several important themes and to provide a review of available archaeozoological evidence. We provide information on relative frequencies of taxa in faunal assemblages to compare animal use through time and space and husbandry strategies of the major livestock based on the age at death. The strongholds as rich and wealthy sites are assumed to reflect these conditions in the diet of inhabitants (e. g. higher number of game and young animal bones). Up till now published partial papers (usually related only to the concrete settlement) focused on determined animal remains suggest that cattle and pigs were managed and butchered on a large scale and the proportion of these taxa varied in different places. On the contrary, hunting and fishing was steadily a complementary source of human diet. So far, differences in animal husbandry and subsistence strategies between strongholds were not investigated therefore we provide the comparison of them.

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The presence of domesticated camelids (*Lama glama*) in the Chaco-Santiagueña region (Argentina) during the agro-pottery stage (350 AC-1550 AC)

The South American camelids have been one of the most important resources since the arrival of the first humans to the continent, and for the South Central Andes the record of the beginning of their domestication around 4400-3000 BP. On the other hand, research for the Chaco-Santiagueña region (classically considered marginal and/or influenced by Andean populations at some point in the cultural sequence) has been based on the agro-pottery stage (350 AC until the Spanish conquest in the 16th century).). The majority of researchers working in the region have interpreted the presence or absence of the domestic camelid species (Lama glama) from ethnohistorical sources or from eto-ecological considerations. However, with the advance of zooarchaeological studies in the region, we were able to infer for a late agro-pottery archaeological site (ca. 1200 and 1500 AD), the presence of specimens assigned to L. glama by the similarity with current standards, through the comparison with osteometric techniques on proximal phalanges and subsequent analysis by multivariate statistical methods. This work incorporates sites from the entire agro-pottery sequence and from different geographical areas of the Chaco-Santiagueña region in order to differentiate camelid species. From the results it can be inferred that the use of domestic camelids was a common practice in the region since the first sedentary groups of the region.

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Exploring the zooarchaeological evidence of otariids exploitation by terrestrial hunter-gatherers along the western coast of San Matías Gulf, Argentina

Along the coast of the San Matías Gulf (GSM, Patagonia, Argentina) it is common to find otariid remains in the zooarchaeological record of terrestrial hunter-gatherers. Whereas fishes were the main resource, otariids served as an important secondary resource. Despite its importance, the knowledge about the exploitation patterns is scarce, due to the small representation of otariid remains in some samples and the difficulties of distinguishing post cranial elements between the two species present in the archaeological record (Otaria flavescens and Arcthocephalus australis). This identification requires the use of multiple methodologies (reference collections, distinctive morphological features and osteometric studies) that cannot always be used together. In this presentation we present the results of the analysis of two zooarchaeological otariid assemblages dated in the late Holocene (PO and QB; ca. 3000 and 1300 years BP, respectively) recovered along the west coast of the GSM. The objective is to explore temporal trends in the mode of exploitation of these animals (species, sex and age selection). Also, given that in the area there are currently otariid breeding herds, this study will also provide information for a discussion on the early distribution of these animals in Patagonia.

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Thinking from a distributional approach: A guanaco (*Lama guanicoe*) archaeofaunal landscape in Southwestern Patagonia (Argentina)

The archaeofaunal analysis of guanaco bones from several archaeological sites located in the valley floor of the Tar and San Martín lakes basins, in the Upper Chalía River basin and other from a highland closer basin is presented. These sites are located in different environments (steppe and forest edge) and correspond to open-air contexts and those located in rockshelters, whose chronologies cover the entire Holocene. Materials were recovered from a distributional perspective seeking diversity, making both bounded excavations and surface collections in a broad spatial scale. Besides, the analysis considers different chronological packages evaluating comparatively the formation processes of the sets and the representation and processing of the skeleton. In addition, bone depositional rates are established on the basis of the NISP. Functional differences between sites (residential and logistical use) and on the intensity of their use were identified. The broad spatial and temporal scale of the archaeofaunal data and the lithic artifactual information, allow evaluating and discussing proposals on the landscape use by hunter-gatherer populations.

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Weathering patterns in bones from recent vertebrates in the Pampas region, Argentina

Bone weathering is a world-wide destructive process which influences the overall preservation of vertebrate remains and masks other bone modifications (such as cut marks and carnivore action). During the last twelve years we have been documenting weathering data in a study of naturally deposited vertebrate remains in the Pampas region (Argentina). The main objective of this study is to generate taphonomic models about natural processes responsible for accumulation, destruction and burial of bones, intended to be used in the interpretation of bone assemblages from archaeological sites. Transect surveys have been conducted in this study to record natural bone distribution in a variety of environmental contexts. Until present, we have covered a total area of 1,046,130 m2, distributed along the coast (501,900 m2), hills (179,310 m2), river valleys (135,300 m2), lagoons (126,670 m2), shallow lakes (75,000 m2), and plains (27,950 m2). We have recorded environmental data and taphonomic modifications on disarticulated bones and articulated bones, and carcasses. In

this poster, we focus in weathering data, in order to evaluate the consequences of this process in different environments and the destruction of bones from different sized vertebrates. The main results indicate that weathering is more frequent in the plains and the coast. We consider that this information provides a frame of reference for archaeologists to interpret assorted weathering stages in the archaeofaunal assemblage.

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3D photogrammetric models based on historiognath rodents: Upper Ongamira Valley, Northern Córdoba Province, Central Argentina.

Within the field of zooarchaeological studies, the application of three-dimensional modeling, developed from registration by photogrammetric techniques, has allowed the development of complete models or specific sections of different skeletons or taxa. Faced with the limited access of reference skeletons, the development of digital models allows through the use as a comparative material to reach levels of taxonomic identification, and thereby achieve replicability of the results obtained through 3D analysis. Photogrammetry is a technique that combines the use of photography and geometry from different levels and scales, obtaining quality results. To obtain the models, digital SLR cameras were used, which allowed a control of the light input, shooting speed and image quality. In addition, it allows obtaining a wide range of work with micro-scale models. The processing of these images was done on the basis of open access 3D reconstruction software such as: Visual Structure from Motion System (VisualSFM), Cloud Compare and Blender. After making 3D models, different measurements were made using the Meshlab program, a parametric software for editing 3D point clouds. Based on this technique, three-dimensional models of a total of 20 cranio-mandibular remnants (MNI = 10) corresponding to 2 species of historiognath rodents, Microcavia australis and Ctenomys aff. C. osvaldoreigi. Both sets coming from the Ongamira valley, located 122km north of the Córdoba city. Each of these taxa is associated with 2 different temporary blocks. On one hand, an archaeological group linked to holocene strata (ca. 3600 BP) obtained from stratigraphic excavations and, on the

other, a current set obtained from the systematic and seasonal collection of owl pellets (Tyto alba). As preliminary results, the implementation of this tool on the sets allowed us to obtain 3D comparative models with high quality results, possible to be used for studies in zoology and zooarchaeology, as reference collections.

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5TH SEPTEMBER WEDNESDAY

Session title:

Zooarchaeology in the Pacific

Session abstract:

This session will explore how the cultures of Oceania shaped economic behaviour, consumption patterns, and taste in the island environments of the Pacific. The papers in this session may focus on how Pacific peoples exploited indigenous resources, including fish, birds, and shellfish. Other papers may address how Pacific peoples used "canoe animals", including pigs, dogs, chickens, and Pacific rats, as well as the impact of these imported animals on indigenous faunal and floral communities. We also welcome papers that examine changes in animal use through time in the Pacific Islands. This inclusive session continues to encourage representation of Pacific archaeologists within the international community of zooarchaeologists.

Keywords: *Oceania, Pacific Islands, human-animal interactions*

Organisers:

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ORAL PRESENTATIONS

Evidence of Maori–kuri (*Canis familiaris*) interactions from a pre-European Maori cemetery at Auckland, New Zealand

Dogs (Canis familiaris, in Maori, kuri) were introduced to New Zealand from East Polynesia during the first period of human colonisation (c. AD 1300). Archaeological evidence found throughout the country demonstrates their use for food and as raw materials for the manufacture of tools and ornaments. European accounts from the 18th and 19th centuries provide additional insights into the important socio-cultural roles of kuri in Maori communities. Often, they were used for hunting, but they were also associated with high status members of society who wore dog-skin cloaks and conducted ritual dog feasts. The introduction of large numbers of European dogs during the 19th century resulted in interbreeding and the loss of kuri as a distinct breed. Archaeological evidence provides a unique opportunity to examine the interactions between people and dogs in Maori communities prior to this loss. Excavations at Auckland Airport in 2008-2009 revealed two 17th century AD burial grounds (urupa), containing a significant assemblage of dog remains associated with numerous human burials, structures and disturbed midden refuse. We use zooarchaeological and ancient DNA analyses to provide new insights into Maori–kuri interactions through the study of butchery practices and demography, as well as variations in kuri phenotype, and kuri ancestry. Our study reveals that a few young male and female kuri were buried in what appears to be symbolic ritual events, while fragmented cooked and de-fleshed dog remains were scattered throughout the midden refuse possibly as part of funerary rites.

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‘The pinnacle of satisfaction’: Archaeological evidence for hakari (*feasting*) in pre-European Maori society

Hakari (feasts) were an essential component of pre-European Maori society. Hakari served to cement relationships within family and tribal groups, as a vehicle for competition between groups and to aggrandise elites. The prestige of elites was intimately linked to the prestige of the group and hakari were communally organised events where considerable quantities of food were gathered and stored for months ahead of time, prepared and carefully displayed prior to consumption. They are well attested ethnographically but to date have received little attention from archaeologists. This paper begins by looking at ethnographic and historic evidence of hakari. It then examines several archaeological cases where an analysis of food remains where a consideration of their context indicates that they may be the remains of hakari.

Matthew Campbell, CFG Heritage Ltd. mat.c@cfgheritage.com

Session title:

Putting the humor back into zooarchaeology

Session abstract:

Western elemental philosophy, the understanding of the cosmos though the four elements (earth, fire, air and water), originated in ancient Greece. Humoral theory developed out of these ideas, linking the elements to the four bodily fluids (blood, yellow bile, black bile, and phlegm), and became the dominant Western ontology during the Greek, Roman, medieval and early modern periods.

Humoral theory described an integrated world, explained the causes of events, and gave meaning to human experience, until its influence ended in the nineteenth century with the development of germ theory. Similar philosophies remain important today in many parts of the world and there have been growing calls for a return to the broad principles of this approach in contemporary society, such as the 'One Health' initiative.

Despite the centrality of this way of thinking in the past, archaeological interpretations seldom interpret evidence within this ontological framework. Jones et al. (2016, 175) have recently called attention to this problem arguing that "these ancient cosmologies … might provide fairer representations of past cultures, through the readoption of ideas that they understood rather than through the imposition of more recent and thus anachronistic frames of analytical reference".

In this session we welcome contributions from anywhere in the world, and from any time period, which evaluate archaeological evidence through the lens of elemental philosophy and humoral theory. Potential topics to discuss in this session include: diet (of humans and animals); animals as medicine; animal health; the perception of animals; and, farming practices.

References:

Jones, R., Miller, H. and Sykes, N. 2016. Is it time for an elemental and humoral (re)turn in archaeology? Archaeological Dialogues 23 (2): 175-192.

Keywords: *Social archaeology, ontology, elemental philosophy, humoral theory*

Organisers:

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ORAL PRESENTATIONS

Let's get humorous…

This paper is an introduction to the session 'Putting the humor back into zooarchaeology'. It will explain the fundamental concepts of elemental and humoral theory which were so integral to past understandings of the body and the world. It shall also touch upon parallel traditions such as Unani Tibb (Greek Arabic medicine) and traditional Chinese, Japanese and Tibetan herbal medicines which also focused on the concept of balance and still play great importance today. This will give context for the papers presented in the session and demonstrate the importance of elemental/humoral theory in understanding the zooarchaeological record, revealing new insights into past diets, health, animal husbandry strategies and perceptions of animals.

Keywords: *Humoral theory, elemental theory, ontology*

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Searching for humors in dark places

Elemental theory and humorism are paradigms of bodily health that are well documented in the Roman, Medieval and Early Modern periods of British History and in some areas of the world persist to the modern day, making it one of the most wide spread and "longest lived of all scientific paradigms" (Foster, 1978, p10). Understanding this worldview can provide a frame work for the interpretation of archaeological data to further our understanding of daily life in the past.

It is not known whether these ideas persisted into the Early Medieval period from the Roman however if they did we must investigate the extent to which people followed elemental principles, and whether other worldviews existed. There is also the possibility that such principles if present developed independently, though this is not the purview of this study.

The aim of this paper is to investigate the extent to which ideas present in Elemental Theory may be present in Early Medieval England using stable isotope data synthesised from published cemeteries across the country. It will examine whether there is an identifiable change in diet at different times of life, possibly dictating an age milestone reached and a perceived change in humoral makeup and therefore dietary requirements. This trend has already been identified as a possibility in Jones, Miller & Sykes (2016) in regard to Neilich et al's work on the Roman Cemeteries of Oxfordshire (Neilich et al, 2011).

Keywords: *Anglo-Saxon, bioisotopes, humorism, social archaeology*

References:

Jones, R., Miller, H. and Sykes, N. 2016. Is it time for an elemental and humoral (re)turn in archaeology? Archaeological Dialogues 23: 175-192.

Nehlich, O., B.T. Fuller, M. Jay, A. Mora, R.A. Nicholson, C.I. Smith and M.P. Richards, 2011: Application of sulphur isotope ratios to examine weaning patterns and freshwater fish consumption in Roman Oxfordshire, UK, Geochimica et Cosmochimica Acta 75, 4963–4977.

Foster, G. M. 1978. Latin American legacy: 'hot' and 'cold' in contemporary folk medicine. In Colloquia in Anfhropology (Edited by Wetherington R. K.), p. 10. Southern Methodist University, Dallas, Tex., 1978.

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Healing the body, healing the soul: Dietary practises within Medieval leprosy hospitals

Excavations at St Mary Magdalen (2008-2015) have revealed a complex, multi-phase leprosy hospital (12th- 16th century) on the outskirts of Winchester, Hampshire (Roffey & Marter, 2011). To date, St Mary Magdalen remains one of the most extensively excavated leprosy hospitals, providing a unique opportunity to further understand the role in which animal products may have played into the daily running of medieval leprosy hospitals.

Several individuals excavated from St Mary Magdalen have displayed advance stages of leprosy, for example, the loss of the palate over time (Roffey & Tucker, 2013). Such afflictions raise the question of how individuals within this hospital were sustained on a diet inclusive of animal products.

Publications such as those by Rawcliffe (2006, 1999, 2013) have discussed the ways in which humoral theory may have been pivotal to understandings of diet and nutrition throughout the medieval period. Publications by Roffey (2013) have highlighted a greater level of care within St Mary Magdalen, challenging negative social perceptions of leprosy.

Building upon these ideas, this paper presents new findings from analysis of the assemblage at St Mary Magdalen highlighting the importance of recorded butchery marks associated with soup and broth making (Van Mensch, 1974) and patterns of fragmentation throughout various species of domestic livestock. Research to date indicates that a multiplicity of practices took place at St Mary Magdalen, demonstrating a flexibility of approach between Galenic practices and religious observation, indicating that the spiritualty of diet was present in the treatment of leprosy in medieval hospitals.

Keywords: *Leprosy, hospital, nutrition*

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Some advice for 'phlegmatic men': A humoral assessment of the faunal remains from Woking Palace

The large faunal assemblage from the medieval and Tudor site of Woking Palace, a royal residence in the United Kingdom dating from c. 1200 to c. 1650 CE, was analysed by a team from the University of Nottingham. During the analysis of these remains several aspects of the material, and indeed the wider site, appeared to warrant interrogation through Humoral Theory. For example the orientation and use of features at the site, including buildings and water management facilities, potentially corresponded with certain humoral principles. Similar findings were made regarding the cuts and types of meat consumed at the site. However, due to the potential issues of equifinality when interpreting these faunal remains, this humoral line of enquiry was not included in the recently published site monograph.

In this paper the remains from Woking Palace are reassessed through the lens of humoral theory. The efficacy of humoral theory as a framework for approaching the zooarchaeological record is considered, as well as the potential pitfalls of doing so. Some notable similarities between modern dietary choices and those of the medieval occupants of Woking Palace are also explored.

Keywords: *Medieval England, Tudor England, diet, humoral theory*

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Food, identity and humoral theory in early modern England: A case study from Leicestershire

Archaeological studies of food have generally taken an isolationist approach: they have tended to consider animal and plant remains separately and have largely failed to integrate written sources. Furthermore, interpretations have tended to focus on economics or on identifying aspects of identity (most commonly social status). A major omission is that evidence has seldom been interpreted within the ontological frameworks of elemental and humoral theory, which were dominant in the west circa 500 BC to AD 1850. My research attempts to address these problems through an interdisciplinary case study – the diet of the Grey family who lived at Bradgate House, Leicestershire (circa AD 1500 to 1750). By studying animal and plant remains from the excavations, the contemporary household account book, and regimen, recipe and husbandry books, I aim to answer the question 'to what extent did humoral theory influence diet?' In this presentation I shall discuss preliminary findings.

Keywords: *Diet, humoral theory, ontology, early modern, Leicestershire*

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Session title:

Mobile pastoralism through the interdisciplinary lens

Session abstract:

Mobile pastoralism, including nomadic, semi-nomadic and transhumance practises, is as much an ancient application as a modern practise which may contain the answer to many problems created by industrialised animal raising. The movement of large number of animals and people through the landscape is shaped by environmental, economic and social factors. In turn, it inputs to all these three in numerous ways. It was thought that markets with high demand in specialised pastoral products was a precondition for the operation of such systems, nevertheless contemporary research indicates that this may not be so and the mobile pastoralism in some form might have been much more ancient.

This session invites papers that will contribute to understanding the beginnings, the history, the structure and adaptation of the system at various natural/social environments and finally its relationship with the organised state and the opportunities/constrains/consequences involved. With animal husbandry sharply at focus, studies through traditional and new zooarchaeological techniques as well as any other disciplines that can contribute to the question, such as archaeology, ethnoarchaeology, biology, (archaeo)botany, history and the study of ancient documents, economy or any other, are welcomed. Most interesting will be the combination of different disciplines' data to the same question.

Organiser:

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ORAL PRESENTATIONS

Horse sacrifice and butchery practices in Late Bronze Age Mongolia

Concurrent with the emergence of horse-based, pastoral lifeways, ritual sacrifice of horses became widespread across the eastern steppes of Eurasia at sites during the late Bronze Age Deer Stone Khirigsuur (DSK) complex (ca. 1200-700 BCE). While previous research highlights the use of horses for food and transport in DSK culture, the dynamics of DSK horse ritual are far from clear. Horse burials typically consist of the skull, jaw, and cervical vertebrae, along with two or four hooves, but elements which might easily remain attached to the hide (tail bones and fractured pieces of limb bones) are occasionally included in DSK ritual features – suggesting that the animal's skin was originally present in some features. To shed further light on DSK horse sacrifice, we conducted detailed osteological and taphonomic study of 23 horse features from across Mongolia. Our results show that some animals were slaughtered through either blunt or in some cases sharp-force trauma to the skull. Cut marks present on many specimens relate to not only to the separation of the skull and neck from the body, but also the separation of individual vertebrae, the removal of meat from the dorsal surface of the spine, and the extraction of the tongue. Together, these data indicate that DSK horse ritual involved the slaughter of horses, the consumption of horse meat, and the burial of hide along with the head, hooves, and neck. This pattern links DSK tradition with earlier and subsequent steppe practices, and underscores the dual significance of horses in both the ritual and economic sphere of early pastoral groups in eastern Eurasia.

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Tumurbaatar Tuvshinjargal, University of Kiel/National Museum of Mongolia

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Companions in life and death: Pastoralism in Middle to Late Bronze Age Naxçıvan, Azerbaijan

The lives of herders are closely intertwined with the animals they herd. They determine their animals' movements, but their mobility is, in turn, structured by the needs of the animals in their flocks. This close relationship has, in some cultural contexts, taken on important symbolic, as well as economic significance. Excavations from the Middle–Late Bronze Age settlement of Qızqala and adjacent kurgans have provided important insights into the pastoral economy of inhabitants of the Ş?rur Plain in the Autonomous Republic of Naxçıvan, Azerbaijan. Zooarchaeological and biogeochemical data from animal remains recovered from middens at the settlement at Qızqala and from burial contexts within the adjacent contemporaneous monumental kurgan burials provide important information on pastoralists' mobility at the period of inception and expansion of political complexity in the South Caucasus. Zooarchaeological data provide insights into ancient inhabitants' animal management practices. Biogeochemical data (radiogenic strontium and stable oxygen and carbon data) are used to assess animal mobility and diet, and thus are proxies for the choices their herders made, shedding light on the relative periods of mobility and sedentism built into inhabitants' seasonal rounds. By assessing both domestic and burial contexts, this study examines the relationship between foodways and ritual practices during the Middle through Late Bronze Ages.

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Who saw the potential? Early pastoral production in the arid margins

Was it indigenous steppe communities or village-based pastoralists that first saw the potential of the arid regions of Easter Jordan for mobile pastoral activities? With what repercussions for the social, cultural, and economic circumstances of the pastoral groups and those settling into early village communities? This paper will present the results of an integrated study into the zooarchaeology, material culture and architecture of the Early Late Neolithic communities of the Eastern Steppe (6900-6300 cal BC), offering new perspectives on the complex social relations and political networks of early herding groups.

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Pastoral economy in the Bronze Age Anatolia

The Bronze Age is a time that has seen the rise of urban societies and the first "states" in the Near East and Balkans. It is also a time that intensive pastoral activities are recorded and what is more they appear regulated by the state. These urban societies and palaces provided conditions suitable for marketing of pastoral products. Specialised communities providing these products may have existed. These communities are likely to have practiced some kind of mobile pastoralism and transhumance to meet the needs of large flocks. In this paper, we present an attempt to investigate together and compare information from Bronze Age texts as well as zooarchaeological work aiming to describe better the possibility that such specialized and mobile communities exist. We start with an overview of the studies on ancient documents of Hitite period referring to information and regulations directed by the palaces concerning the management of sheep flocks. We then turn to zooarchaeological finds from the Hittite site of Şapınuva, Çorum, Turkey, focusing on mortality profiles to discuss indications for specialized mobile communities.

Keywords: *Late Bronz Age, Hittite, secondary product*

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POSTER PRESENTATION

Beyond counting sheep: An interdisciplinary review of faunal assemblages in the British pastoral landscape

One of the many challenges in zooarchaeological research is to explore better methods of addressing the relationship between animal husbandry and cultural and environmental change. Intensification of wool production is typically evidenced by an increase in the relative abundance of sheep at the expense of cattle, and increased use of adult sheep with changes in mortality patterns. However, when applying quantitative methods of species abundance to describe pastoral systems, mixed-farming strategies that utilize many aspects of animal production can complicate the evaluation of herd structures and species predominance. To further explore how the intensification of sheep husbandry in relation to wool production is represented in the archaeological record, this project aims to provide reproducible analysis based on environmental, geographical, and temporal factors. The application of exploratory data analysis and computational archaeology with zooarchaeology provides a system of data management, quantitative analysis, and model-based testing for intra-site distribution studies, inter-site variability, and regional trend assessment, through consideration of individual assemblage data. Datasets from published assemblages are presented in case studies that move beyond descriptive approaches and data visualization based on derived metrics, towards interpretations that reject regional generalizations for pastoral systems and focus on trends based on the integration of faunal and environmental data with statistical analysis. Advancement in zooarchaeological methodology that considers synthesizing multidisciplinary data will assist in future collaboration within research teams, create new perspectives on site variability, and help further refine current understanding of past socioecological relationships.

Keywords: *Pastoralism, wool production, quantitative metrics, exploratory data analysis*

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Session title:

Bone refits in faunal analyses: Case studies and applications in archaeological assemblages

Session abstract:

From an archaeological point of view, the abandonment of remains allows past human activities and occupations to be reconstructed. In the case of faunal studies, once the nutritional value is exploited, bones are thrown, generating a set of accumulations that, together with other processes, leads to a deposit formation. One of the main problems is that palimpsests are formed by multiple human occupations and disrupting processes that occur over time.

The first bone refit studies, which examined on European Middle Palaeolithic palimpsests, were carried out in the 1970s in order to answer questions concerning the diversity of Neanderthal behaviour, including site function, seasonality and domestic areas. Currently, works about specific sites are mainly focused on the reconstruction of human subsistence strategies and how hominins interacted with the natural environment.

Bone artifact refitting is a valuable aspect of archaeological research that can inform researchers on a variety of issues, such as prehistoric technology, site taphonomy, assemblage patterning and function. This technique offers a means of analysing sites with complicated occupational histories and is particularly useful in interpreting bone scattering on the surface. Refitting is also an intensive and time-consuming labour, especially for inexperienced refitting analysts, making it logistically challenging if many research projects are being conducted simultaneously.

In this session, hominin occupation patterns and space use in caves, shelters and open-air sites will be explored, as well as site formation processes, by means of bone refitting and correlated spatial analyses. The scope of this session will not be restricted to Palaeolithic sites but will examine all chronological periods. Not only analyses focused on (a) specific site(s) or level(s), but also interdisciplinary contributions are invited. This session will bring researchers together from different generations and research traditions to review the most important developments and impasses in bone refitting studies.

The aim is to debate the current research situation to learn about the efficiency of this methodology and inspire participants to make creative proposals on how to tackle and conceptualise bone refits.

Organisers:

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ORAL PRESENTATIONS

Bridging gaps – surface discontinuities in mechanical bone refits

This paper compares observations of mechanical refits (sensu Lyman 2008: conjoining fragments from an original entitiy) of long bones of larger ungulates, deriving from different archaeological settings: a Mesolithic rockshelter, Late Bronze-Age burials, a medieval castle and a post-medieval urban building. The individual sets comprise 2-5 fragments.

In contrast to bilateral and most intermembral or occlusal refits, matching fragments are easily identified by conjoining fracture edges of cortical bone. The procedure is therefore similar to the refitting of stone tools and pottery fragments. If fragmentation occurred during butchery, traces of impacts or toolmarks may also be noticed.

In order to become archaeologically visible, mechanical bone refits normally require some degree of spatially related deposition of the specimens involved. This may well be the reason why conjoining fragments of bones resulting from chopping with metal tools are but rarely reported – they seldom end up in related contexts and are beyond the scope of recognition. Butchered grave-goods are one possible exception. Among the case-studies presented, conjoins along splits caused by tools, or along butchered surfaces proper, could only be verified in the post-medieval building, which represented a protected taphonomic environment.

A common feature of all sets are differences in preservation conditions among the elements. They appear as surface discontinuities in the refits, obviously linked to pre- or post-depositional modifications. These discontinuities comprise differing colourings due to heat influence, metal discolourations, and slight changes of the surrounding matrix. Resulting from fragment dispersal, they are a distinctive feature between pre- and post-depositional breakage.

Keywords: *Butchery; long bones; metal tools; bone modifications; refitting*

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Using differential geometric methods to improve zooarchaeological methods for refitting fragmented faunal remains

Many key sites for understanding human evolution have massive bone assemblages with hundreds of fragments that cannot be identified to taxon or skeletal element. Refitting is the primary method for increasing the number of identifiable specimens. However, manually refitting fragments is time-consuming and daunting, akin to assembling hundreds of jumbled-up, pictureless, 3D puzzles that have missing pieces. Additionally, there is no a priori knowledge of the shape of the underlying puzzle, i.e. skeletal element. Thus far, methods for computer-assisted refits use fragments from known skeletal elements where the general refit is known. Moreover, these methods require high levels of graphical user interface, which is impractical for large assemblages, and reference models, which are unavailable in zooarchaeological contexts. The pioneering work of Hoff and Olver (2014) and Grimm et al. (2016) use differential geometric signature curves to automate refits that do not require a picture or a priori knowledge of the shape of the puzzle. Curve matching algorithms apply curvature and torsion invariants along break edges to rapidly cycle through entire assemblages to identify potential refits. Here we present preliminary work in the development of methods for automatic refits using a

small sample of experimentally broken bone fragments. These findings serve as the basis for ongoing efforts to develop methods to refit assemblages with hundreds, or even thousands, of fragments. The ability to automate (or even semi-automate) the refitting of large assemblages of fragmentary skeletal remains using shape would radically transform zooarchaeological research methods.

Keywords: *Bone fragments, automated refits, 3D modelling*

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Bone refits in faunal assemblages K and M Levels of Abric Romaní site (Capellades, Spain)

The characterization of Neanderthal groups is approached by analysing both their behaviour patterns in several environments and their spatial organization in different types of occupations. The availability of resources, its management and exploitation, as well as other variables, such as seasonality, group size, occupational length and function or interaction with the occupied space, generate different types of settlements as result of adaptive strategies in specific environments. From an archaeological perspective, bones refits have demonstrated to be one of the best guide-elements to identify settlement dynamics of the occupation spaces (site functionality, domestic areas, temporal connections and socio-spatial organization), and resolve questions related to time such as events/episodes in archaeology (palimpsests). Here we present bones refits from K and M archaeological levels of Abric Romaní site (Capellades, Spain), dated to 50-55 ka. The Abric Romaní site is one of the few examples in the Iberian Peninsula showing taphonomic studies of bones refits in the most of archeological levels. This study has allowed us to compare different anthropogenic occupational patterns, including large groups that develop long-term occupations with numerous repeated events and high spatial interaction (level M), and medium or small groups that perform less intense and short-term occupations (level K).

Keywords: *Neanderthal's occupational models, behaviour, Abric Romaní, bones refitting, spatial patterns*

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Space, time and movements: How bone refits can be used to reconstruct Neanderthal's occupational models: The case of Abric Romani (Barcelona, Spain) and Riparo Tagliente (Verona)

Neanderthal's material remains have been studied from a variety of perspectives with the aim of reconstructing different life-aspects of these human groups. The arrangements of artefacts and features within archaeological sites have often been employed to isolate activity areas and draw inferences about site function. This assumes that objects found in close proximity, were used for the same task, and that artefacts were usually discarded where they were used.

In this regard, refitting studies provide useful data in order to achieve some topics like: assemblage formation processes, post-depositional dynamics, settlement patterns, definition and integrity of stratigraphic units. The distribution of the remains and the connection lines documented by refitting, allow understanding the modalities of space-organization, how human groups divided themselves, how they relate to each other and the relationships between the site areas.

The aim of this paper is to present the application of this methodology in the Middle Palaeolithic levels I and Ja of Abric Romaní (Barcelona, Spain) and level 37 of Riparo Tagliente (Verona, Italy). This approach is correlated with neighbourhood analysis and spatial distributions, allowing to reconstruct both natural and cultural processes involved in this record, in order to explore the anthropogenic use of the site, the differences between occupational patterns, subsistence activities, domestic areas, level of groups sophistication and the length of the occupation. Summarizing the collected data, different situations can be noted. Abric Romaní site shows two different occupational models: short-time occupations around small hearths, representing domestic activities in level I, and a mixture of short and large occupations in sublevel Ja, with synchronic relationships between activity areas and toss zones. A different situation has been highlighted at Riparo Tagliente, where the particular formation-site processes, led to the identification of more palimpsests, that consequently have reduced the amount of refits.

The resulting data could be used as a reference to investigate the patterns of occupation and subsistence of Neanderthals in Europe. The interaction of multidisciplinary approaches will improve our understanding of the Neanderthals daily life in a more detailed level.

Keywords: *Neanderthal's occupational models, Abric Romaní, Riparo Tagliente, bones refitting, spatial patterns*

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Session title:

Teeth: To know, to eat, to use

Session abstract:

Teeth are a fundamental archive of useful information for archaeozoological, anthropological and taphonomic research. They help in the reconstruction of the paleoenvironment, palaeoeconomy, and culture from prehistoric to modern times. They are organs of the oral cavity responsible for the primary function of chewing and preparing food for digestion and represent an indispensable tool for identifying species and for estimating sex, age and season at death. In some cases, they may indicate illness and disease. Finally, in all periods of human history, the teeth, preferably of carnivores, but also of other animals have been choosen for their shape, colour, brilliance and resistance. They were extracted from the dental arcade to make tools and ornaments. They were used for personal adornment, with a symbolic meaning or as elements of prestige or, in some cases were worn to intimidate the enemy (eg, ornaments for the mouth).

This session aims to bring together specialists who deal with these themes to analyze all the information that may be derived from the teeth. The themes include taxonomic determination, wear, paleopathology, mastication marks, use as raw material, as a tool or meta-tool (spinning, handle) and as ornaments from Prehistoric times to the present day. This session will also deal with ethnographic comparisons, highlighting new approaches, methods and innovative diagnostic techniques for specific identification and age, analysis of gnawing marks (human, carnivores, rodents and ungulates), the techniques of extraction, processing and use of the teeth.

Organisers:

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Keynote speech:

Discussant:

Opportunities and Challenges of Addressing Global Challenges through

Zooarchaeology. Terry O'Connor, University of York, terry.oconnor@york.ac.uk

ORAL PRESENTATIONS

Preliminary taphonomic results about dental wear analysis

Some researchers already raised the question of the tooth enamel robustness against taphonomic alterations which may occur during burying and other sedimentary or biological processes. Indeed, various taphonomic factors could occurred such as abrasion, dissolution, weathering, anthropic or carnivores alteration on tooth material. Each one of them could potentially leave specific marks which, for most of them, are easily identifiable. Thus, the altered teeth can be generally excluded or counted apart from the study (Gordon, 1984c; King et al., 1999; Camaros et al., 2015). Nonetheless, despite these suggestions, no rigorous study on a large amount of dental material submit to various conditions was conducted.

A special case concerns the degree of alteration of enamel when conducting micro-wear studies. Such studies observe micro-marks (pits, grooves, punctures...) in order to infer diet regime of species. But bias due to taphonomic factors are not yet been fully investigated within this study context. We have tested macro and micro impact from various dynamic contexts on horses and bovids teeth. Samples were display in four locations: moving water, standing water, Miocene sands and clay sediment. The first two remained alone during 6 months and the others were trampled at least twice a day during 6 months. The state of the teeth before and after experimentation was compared from a macroscopic and a microscopic point of view after 6 months. The most impactful context seems to have been the standing water but, more generally, only small differences are noted before and after experiments. However those preliminary results are encouraging and both more parameters and contexts need to be investigated with a larger amount of teeth. Microwear analysis is based on quantitative studies of micro-traces left on the enamel surface and then it becomes crucial to determine the level of confidence we can have in the enamel recording.

Keywords: *Taphonomy, dental wear, bovid and horse teeth*

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Assessing prehistoric bison exploitation at the Palaeolithic sites of Isernia La Pineta (Italy) and Caune de l'Arago (France) through a study of their dental remains

The paper focuses on the study of Prehistoric bison dental remains from the open-air Lower Palaeolithic site of Isernia La Pineta (Italy; NR-110) and the Middle Stratigraphic Complex of the Caune de l'Arago (France; NR- 633) which helped to better understand some additional facets of their exploitation. The methods employed to examine their stage of eruption/substitution of teeth, degree, and intensity of occlusal surface use, abrasion and reduction of crown height and length and form of roots provided new data and was compared with previous similar studies from the two sites. Results show that specific degrees of wear, associated with each age class were similar for both maxillary and mandibular teeth for bison from both sites. Their cumulative mortality profiles revealed that at Isernia and Arago, adult individuals were clearly the preferred profitable choice for consumption. At Arago, in the lower levels, which were seasonal habitats, selective hunting halts, short stays or bivouacs, the young individuals were not considered as a profitable economic choice. In the upper-level G, which were long-term stays with non-species-specific hunting, young were also hunted and consumed. However, the young were hunted and consumed lesser and lesser in the subsequent upper-level F, which were seasonal habitats with species-specific hunting, along with a decline in adult age class representation too. At both sites, the representation of subadult and senile fluctuated and remained much lower than other age classes through subsequent occupation layers.

Keywords: *Isernia La Pineta, Caune de l'Arago, Bison, teeth use-wear, age class*

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Taphonomical studies of teeth as possible raw material: Human use and modifications at Cova Eirós Cave (Galicia, Spain)

Teeth are very important for zooarchaeological and paleoclimatic studies since they are decisive in taxonomical studies, to determinate taxa, age mortality profiles and seasonality patterns. They are very important to understand also diagenetical process, such water erosion, weathering or mineral deposition. These taphonomic phenomena affect so much bones surfaces than teeth, especially in cave context where biological and geological activity is high. In Prehistory, caves were very important for human and carnivores' occupation, and their physical characteristics allow the faunal remains preservation.

Cova Eirós is a cave located at 780 m a.s.l in the NW of the Iberian Peninsula (Triacastela, Lugo). It is located at the end of a naturally communicating corridor between the Cantabrian coast and the central plateau of the Iberian Peninsula. The stratigraphy records 6 archaeological layers of carnivore and human occupation, spanning from the Mousterian to the Maddalenian.

Teeth preservation is very good at Cova Eirós, with more than 400 remains. Red deer, roe deer, chamois, bison, bears, wolf, hyena, fox and horse are represented. All teeth fragments had been identified in order to determine taxa, age of death and death season. Taphonomical studies has been applied for all teeth (macroscopical and a microscopical analyses) to determine biological and possible human modifications. Some teeth showed taphonomical alterations that looked as chops, heat-chippings, carnivores' modifications, percussion-marks and cutmarks. Red deer residual canine and fox canine shows evidences of perforation; bear teeth show possible cutmarks and human intentional fragmentation of root. The scarcity of quality of lithic raw materials nearby has probably played an important role in the use of faunal remains by human groups.

Keywords: *Taphomomy, carnivore marks, human modifications, Spain*

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Teeth pathologies of Early Medieval horses from excavations in Poland

Horse remnants in fossil materials are rare compared to these of other domesticated animals. Teeth are such remains that carry a lot of information about their owner, and also they are macro-remains whose preservation degree often allows an even more detailed analysis, than for bones. These studies were carried out on 21 adult horses of both sexes, consisting of 15 skulls and 6 mandibles. All the material originated from main Polish archaeological sites that date back to 11-13 century. Three skulls and one mandible proved to be valuable for research on dental pathologies of horses from the studied period. The X-ray images and detailed photographs were taken for them.

Based on the material analyzed, it was found that there is a partial sloping overgrowth of Triadan 306 and 307 which is colloquially termed "wave mouth" i.e. possibly due to infundibular caries or some other pathological change. There are abnormal changes to the caudal aspect of the 109 tooth, especially to the caudo-buccal root, likely caused by deep periodontal disease resulting from a diastema present between the 109 and 110 teeth. Also there is evidence of chronic osteitis of the rostral aspects of the maxillary bones bilaterally. Most commonly this is due to diastemata formation being an advanced secondary periodontal disease and extension of the osteitis to the adjacent

supporting bones. Teeth alveoli are filling with spongy bone – that is indicative of a longer term tooth loss.

Keywords: *Horses, pathologies, teeth*

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Who ate whom? Carnivore tooth marks on animal bone remains

The presence of animal bones showing carnivore tooth marks is very common in Upper Palaeolithic and Mesolithic Italian caves and a careful taphonomic analysis of such remains may be crucial for understanding details of human and/or carnivore occupation of the sites.

The present research focuses on specimens with predator modifications from some caves in the Fucino Basin (Central Italy). The faunal assemblages recovered at these sites includes ungulates and small mammals, the latter are in some cases particularly abundant.

Previous investigations suggested that the accumulation of the small mammal remains (mainly lagomorphs, rodents and carnivores) in these caves was mainly referable to predator activity. The aim of the present study, based on detailed analysis of microscopic, morphological and dimensional characteristics, is to verify the possibility to asses more reliably the carnivore taxon responsible for such modifications and consequently for the accumulation of the small mammal component of the faunal assemblage.

The study will take into account all the predator species that were present in the area around the caves and were able to introduce small preys inside their dens. The analysis of bone surfaces and puncture marks will be performed by means of a stereomicroscope and a scanning electron microscope directly on the specimens and/or on casts made of epoxy resins

The goal is to evidence, using the large available sample, diagnostic morphological traits and dimensional classes of pits and punctures in order to identify the tooth that produced them and eventually attribute the marks to a specific carnivore taxon.

Keywords: *Taphonomy, Upper Pleistocene, carnivore modifications, tooth marks*

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POSTER PRESENTATIONS

Carnivore tooth marks on bones in a natural karst trap (Cava a Filo, Croara, Bologna, northern Italy)

Faunal assemblages can be accumulated by several categories of bone-accumulating agents and carnivore are no doubt one of the most important than any others. In the recent excavation at Cava a Filo, carried out from 2006 to 2011 and encouraged by the Museo L. Donini di San Lazzaro di Savena, the new geological data have allowed in particular to understand that the abundant Pleistocene mammalian fauna (*Bison priscus, Megaloceros giganteus* and *Capreolus capreolus*) had settled in a sedimentary context originated in a karstic system with relic fluvio-karstic galleries. This particular environmental setting, with water, closed depression and karst sinkhole, proved favourable for the hunting of various animal species, primarily the great steppe bison, both by human and by medium-large predators like the wolf, the only carnivore recovered on the site, during the Last Glacial Maximum (ca. 24,000-18,000 years ago, MIS 2). From the point of view of prehistoric research, this is a particular site because even if it is not a primary deposition site, it constituted a natural trap very favourable for hunting large herbivores. Humans and wolves lived thus in the same environment, sharing the same objective: hunting the great steppe bison. While few "secondary" anthropical evidences could demonstrate the existence, not far away, of hunting activities devoted to bison practised by Upper Paleolithic hunter-gatherers' groups, wolves seem to have strongly modified the bison carcasses, leaving tooth marks on the whole skeleton' s elements. This paper aims at analysing these marks in order to define the main agent of bone assemblage accumulation.

Keywords: *Last Glacial Maximum, carnivore tooth marks, karst deposits*

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Human tooth marks: An experimental approach to Helmeted Guinea fowl (*Numida meleagris*)

Past taphonomic studies have interpreted gnawing marks on bones as the result carnivores' activities. This has led to attributing bone remains accumulations to animal predators, fully or in part, depending on the context and evidence of human presence at the site.

Recent studies have shown that in consuming small game, humans can leave gnawing marks similar to those of small carnivores. This resemblance, may undermine the interpretation of the nature of faunal assemblages. Some studies have described some key features, but it is still unclear, in certain cases, how to reliably distinguish anthropic from other animal traces. In fact, despite the morphology of human teeth being different from that of the carnivores, it is not always easy to distinguish marks on bones, as they may vary according to the applied force, type of tooth, duration of gnawing, quantity of meat present and probably also to the age and to the sex of the chewers, etc.

In the case of birds, the structure and dimension of their bones, make it even more difficult to distinguish between human and animal agency.

For the above reasons, it is central to create a reference collection of human bites/chewing traces, made on the bones of various vertebrate species. This collection should comprise high magnification images. In this vein, the present study, the first of a series of planned experimental analyses, focuses at

describing marks related to human consumption of the Helmeted Guinea fowl (*Numida meleagris*). This species can be a good proxy for some wild birds, due to its skeletal anatomy and bone structure. This study aims at adding useful indications on variability in the meat consumption and to contribute to define guideline to distinguish human chewing marks from the animal ones.

Keywords: *Experimental analyses, reference collection, human consumption, birds, chewing marks*

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Supernumerary cheek tooth in a Byzantine horse from Turkey

Introduction: The subject was a mandible belonging to a morphologically mature horse, discovered during excavations at Theodosius Harbour in Istanbul, Turkey that had a developmental molar tooth abnormality, i.e. a supernumerary molar tooth.

Material and Method: The analysed material consisted of a right-sided mandible, belonging to a horse aged approximately 9–11 years at the time of death. This age was estimated by examination of the very well preserved incisors, including assessment of the oval shape of their occlusal surface, and the presence of some residual infundibula in all incisors. In this study, the Triadan system of equine dental nomenclature was used to identify individual teeth. The well preserved undamaged right mandibular bone had loss of Triadan 406 and the presence of a caudally situated supernumerary molar tooth (Triadan 412). The attached rostral aspect of the left mandibular bone contained an incisor tooth and a portion of the left physiological diastema. The presence of fully developed and erupted canine teeth confirms it was a mature male horse. This specimen is a part of a collection owned by Osteoarchaeology Practice and Research Centre, Department of Anatomy, Faculty of Veterinary Medicine, Istanbul University. The age of this specimen was estimated by radiocarbon dating (14C) as being from the period of Late Byzantium (15th century CE).

Results: This is an interesting case due to the rarity of supernumerary molars in archaeozoological materials, and also because it is the only such case of equid polydontia from the late Byzantium period from that archaeological site.

Keywords: *Turkey, horse supernumerary teeth*

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Upper Paleolithic teeth ornamental objects in north-eastern Italy: Aurignacian vs Gravettian, comparing of processing techniques

In the broad debate concerning the evolution of human behavior and mobility patterns that occurred during the Upper Paleolithic, animal teeth, preserved in some deposits and used by Anatomically Modern Humans as ornamental and symbolic objects, played an important role. Personal ornaments respond to a universal human need: to communicate.

Two important Northeastern Italian sites, “Grotta di Fumane” (VR) and “Grotta del Broion” (VI) reveal special attention to *Cervus elaphus* teeth.

At Grotta di Fumane, in the Protoaurignacian levels, this category includes four incisors of red deer with grooving at the level of the third intermediate of the root. Both stereomicroscope and 3D digital microscope allowed to identify a similar processing for all teeth. The groove, that at first glance appears circumferential, effectively consists of a series of consecutive traits.

A different technological process has been recognized on some of the 8-atrophic canines of red deer recovered in the Gravettian levels of Grotta del Broion. The best-preserved teeth present a preliminary thinning of the root by scraping. This was followed by drilling which was performed through bilateral rotation. Moreover, the hole's position in the three canines suggests that they were rigidly and laterally tied to clothes or used as a *parure* element. Red ochre is present on most of the perforated canines and testifies the plausible coloration of the teeth or the support on which they were suspended. In general, the choice of red deer seems related to its importance in both the Aurignacian and Gravettian hunters-gatherers economy.

Keywords: *North-Eastern Italy, Upper Paleolithic, teeth ornamental objects, Cervus Elaphus*

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Elephant or Mammoth Ivory? Distinguishing the species on a Bronze Age ivory artefact by measuring Schrengen angles

Since some years ago archaeological evidences about the use of ivory as raw material by Bronze Age craftmen were testified only during the end of the Bronze Age in the village of Frattesina (Rovigo, northern Italy). A recent study, carried out on a collection of animal hard materials artefacts exhibit in the Archaeological Museum of Legnago (Verona), allowed the identification of an ivory object, that testifies the circulation of this material in the Italian peninsula. The artefact, recovered in the Late Bronze Age site of Lovara di Villabartolomea (south from Verona, Italy), was previously classified by the archaeologist as a bone pendant.

From a preliminary analysis we identified the raw material as Elephantidae ivory due to the presence of Owen and Schregen lines. In the genus *Elephas* and *Mammuthus* the Schrengen lines intersection show a different texture. This work was aimed at analyzing the object with incident light for measuring Schrengen angles in order to identify the species.

However, the measurement of the angles was particularly difficult as the remain was intensely worked and only in some areas the Schregen lines were barely visible at the stereomicroscope. In the small areas where angles were measured, it was possible to ascertain that elephant ivory was used.

Keywords: *Elephantidae enamel, Schrengen angles, Bronze Age, Horthern Italy*

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General Session:

Dogs and Cats

ORAL PRESENTATIONS

Paleogenomics of pre-Columbian North American dogs

Dogs were the first species to be domesticated ~15,000 ago, several thousand years before the advent of settled agriculture. In the New World, the first unequivocal dog remains date to >9,000BP, and previous studies suggested that early American dogs were transported by people arriving from the Old World and were not independently derived from New World wolves. European domestics then largely replaced the early North American dogs, though modern New World dogs may retain a degree of ancestry from the first American dogs. This suggestion remains controversial, however, since the ancestry of pre-Columbian American dogs has yet to be established. As a result, it remains possible that dogs were domesticated independently in the New World before being replaced by dogs from either Asia or Europe. To test this, we generated four nuclear genomes and 79 mitochondrial genomes from ancient North American dogs including some of the earliest dog remains on the continent (>9,000BP). These data allowed us to assess whether dogs were independently domesticated in North America, when they were replaced by Eurasian dogs, how many times they were replaced, and the degree of extant pre-Columbian ancestry in modern North American dogs.

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Pets of 12th-14th AD Komana, Turkey

This work investigates dog and cat remains from the 12th – 14th AD layers recovered from the excavation of Komana, Tokat, Turkey. It includes 2 almost complete dog skeletons and one kitten plus other bones of dog and cat found scattered in the layers. The two dogs were found buried hastily. One of them shows heavy pathologies such as arthritis and infections. The kitten was found in a cesspit together with large amounts of domestic refuse. The rest of the remains are found in tertiary contexts. We present here the osteobiography of these finds in all detail but with an emphasis on osteometry to specify size, weight and shape of animals. Comparable finds for cat are very few but for the case of dog large datasets recently published from Yenikapı and Van excavations which allowed us to build good comparisons.

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The master and his best friend: The role of the dog in human life and beyond in the Southeastern Alpine region during Roman times

The dog (Canis familiaris) was the first animal to have been domesticated by the Upper Palaeolithic hunter-gatherers, with the gray wolf (Canis lupus) being regarded as its only ancestor. Initially, dogs could have been useful to man as hunting companions and protectors, possibly also by performing cleanup functions as can still be seen in indigenous societies traditionally living with these animals. Nevertheless, by far the best-attested use of early dogs in most parts of Europe is as meat-producing animals and as a source of pelts. An almost complete cessation of the cynophagy in Europe and the Mediterranean is presumed to have taken place with the introduction of new culinary habits of the Roman world. Other dog functions, however, were still very praised. In the South-Eastern Alpine region, a prominent manifestation of its special cultural role is to be seen in relatively numerous examples of its artistic depictions (e.g. mosaics, amber figurines, epigraphic records) as well as in individual burials of these animals and depositions of single bones as grave-goods. Examples of dog carcasses dumped in road ditches and alike represent the other extreme of the human-dog relationship

of the time. In this presentation, archaeological and archaeozoologiocal records of the perception of the dog by the Romans in this part of Europe will be combined with the information provided by the texts of the time in an attempt to get a deeper understanding of the importance of this animal in the local communities.

Keywords: *Slovenia, Roman period, perception of the dog, dog burials, dog symbolism*

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New data on the morphology and health of Early-Roman household pets (cats, dogs) from the Red Sea port Berenike, Egypt

Within a common attitude of ancient Egyptian civilisation, animals could be seen as inextricable and indicative elements of the belief system. Their special role is manifested in the rich iconography and the plethora of animal mummies deposited by the main sacral complexes. In this background, the cemetery of small animals excavated since 2011 in the Red Sea port town of Berenike, dated to 1st-2nd century AD, is highlighted as a unique phenomenon, setting apart the spiritual aspects of cats and dogs. In contrary to other Egyptian animal burials of all periods associating human ones, the Berenike inhumations were not intended as the afterlife companions of their last owners– they had not been mummified as well. Recent results of research present here the species of animals kept as household pets and insight into their behaviour. Pathological changes on one of the dog skeleton suggests osteosarcoma. The Berenike data shed also a new light on the moment of common dispersal of the cat beyond Egypt and becoming one of the favoured pets of Europe and the Middle East.

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POSTER PRESENTATIONS

Pre-Columbian domestic dogs (*Canis familiaris*) at Southern-south America

The recent recovery of several remains of pre-Columbian domestic dogs at the southern South America raises new questions about the origin and significance of this distribution. In this work, we present and discuss different aspects and questions related to new findings of pre-Hispanic Canis familiaris based on the results obtained from different analytic procedures. To that end, the analyzed sample comes from Argentina, Uruguay and south of Brazil, in complement with already published data. Based on radiocarbon dates on the specie remains (taxon-dates), we evaluated its chronological range and spatial distribution (among different areas and archaeological sites). In addition, we present new anatomic keys and morphological criteria for the postcranial skeleton, which helped in its taxonomic identification and constitutes a new analytic approach to recognize local pre-Hispanic dogs and to differentiate them from local wild canids. We will also discuss the results of isotopic analyses to reconstruct the diet of domestic canids, together with considerations about their life cycle and potential breeding area. Finally, we incorporate to the discussion new mitochondrial DNA results, and we compare them with the already published molecular results with the aim of understanding their phylogenic position and to precise the degree of molecular similarities between the regional C. familiaris individuals.

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Dogs in antiquity and late antiquity from South Bulgaria archaeological sites

The poster will present archaeozoological information about dogs, based on bone remains from several archaeological sites in South Bulgaria. The chronological range of sites is from 1st to 6th century, which includes Roman period and late antiquity. Dog bones are gathered during excavations of different types of settlements and they are found in different contexts. For example, some of the sites included are veteran colony (Deultum), Roman villa rustica (Miroviane), Roman tower (Nebet Tepe, Plovdiv), partly excavated cities (Heraclea Sintica, Augusta Traiana, Kabyle). This poster seeks to give an answer to few problems related to dogs. It will try to answer about possible roles of the dog in their relationship whit human. It will also try to give an answer if there some differences or similarities between mentioned above archaeological sites, which include percent of dog bones, breed, age, use of dogs and others. Archaeozoologiacal analysis of the bone assemblages provides some information about possible breeds, height and age of some individuals. It will present information if there are cases of burning, pathology and butchering. The poster also includes few cases of burials, which can give partly answer how ancient people care about dead dogs.

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General Session:

Asia

ORAL PRESENTATIONS

Zooarchaeological investigation of Monitor Lizards (*Varanus sp.*) from Hoabinian archaeological deposits in continental South-East Asia

Several Late Pleistocene and Holocene South-East Asian archaeological deposits are known to contain important osteological assemblages of Monitor lizards (Varanus sp.). This taxon could be of primary interest for zooarchaeological and paleoenvironmental questions as it is nowadays represented by several species occupying different ecological niches (dry and moist forest, proximity of water flows…). However the archaeological remains of these lizards were never fully investigated from an anatomical point of view and the issue of their specific identification remains poorly resolved. We tried to solve this issue by performing an anatomical study of the skeletons of modern Varanus species occurring in the Sunda region in order to define osteological characters allowing for their identification in the fossil record. The results of this investigation are then used to study fossil Varanus from two Late Pleistocene and Holocene Thai archaeological deposits occupied by Hoabinian hunter-gatherers, the sites of Doi Pha Kan shelter and Moh Khiew cave. The obtained data provide information about the exploitation of these lizards by Hoabinian populations and about the past geographical distribution of the different Varanus species occurring in this area.

Keywords: *Squamate, Thailand, Hoabinian, subsistence strategies*

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An investigation into the prehistoric subsistence and sacrifice customs in Huai River basin: A case study from Jinzhai Site, Anhui province, China

Huai River is an significant river located in eastern China, between the Yellow River and Yangtze, mainly running through Henan, Anhui and Jiangsu provinces. Jinzhai site, dated from late period of Dawenkou Culture to Longshan period (about 5000-4000BP), lies in the south of Anhui province. It was excavated by Anhui Province Cultural Relic Institute of Archaeology in 2016 and 2017. Over 1500 animal bones were unearthed, including pig, Bos, small deer, sika deer, big deer, sheep, rabbit and dog. The figure for pigs is dominant, accounting for over 90% of NISP. By examining the animal skeleton remains unearthed from Jinzhai site, there are some bones belonging to domestic pigs as well as wild boars, mainly domestic ones. It indicates that ancestors' meat resource is mainly from domestic pigs, supplemented by hunting wild boars and deers. A large number of intact pig bones found in two ditches beside tombs may be related with feast activities. In addition, burnt animal bones in pits next to tombs also show some old sacrifice activities of ancient people. Jinzhai site exactly offer some precious materials for the research of prehistoric people's subsistence and sacrifice customs.

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Shepherds and farmers in Central Asia: New clues about animal exploitation from the Samarkand Oasis from the Hellenistic to the Islamic period

Since ancient times, the economy of the Samarkand Oasis (ancient Sogdiana, modern Uzbekistan) is based on the integration between irrigated farming and semi-mobile pastoralism. A long-term landscape exploration in this area demonstrated the presence of a complex network of artificial canals, which supplied with water the cultivated fields around the city. According to this pattern, the piedmont areas pertained instead to pastoral communities. This research is based on the analysis of ca. 9,000 faunal remains from four sites in the Samarkand area, excavated by the Uzbek-Italian expeditions of the universities of Bologna and Napoli "L'Orientale" in collaboration with the Institute of Archaeology of Samarkand. The analyzed sites had different functions and chronologies, including small rural settlements dating between the last centuries BC end the first centuries AD (Sam-486 in the Kurgan Kadirbeg complex and Sam-174), as well as fortified administrative and residential settlements covering the period between the 4th century BC and the 13th century AD (Kafir Kala and Kojtepa). Zooarchaeological analysis attested that sheep & goats were predominant at all sites, but revealed different patterns of exploitation in terms of flocks composition and lifetime products economy. Cattle followed for economic importance, while the presence of equids and pigs varied from site to site. Even if rare in the faunal assemblages, the few identified remains of wild animals, mainly foxes and boars, contribute to further expand the overall set of animals exploited in the Samarkand Oasis and demonstrate the persistence of occasional hunting activities.

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Role of study of correlation between archaeozoological and contemporary literary sources in context of ancient India

The correlation between archaeological and literary evidences from past can add new dimension to the subject of archaeozoology. With advancement of scientific techniques and methodologies, it is possible to shed light on many aspects of faunal utilization from the past. An equally crucial aspect to understanding the human animal interaction in the past is ‘how the animals were perceived and understood by the contemporary people that shared their environment, which is reflected in literature.’ The focus of this work is data from Sanskrit texts composed between roughly 1200 BCE to 300 CE, and the archaeozoological data from excavations of sites from India, belonging to the same time period. The literature studied covers ancient Indian Sanskrit texts of Vedic tradition, from Brahmana texts to Smritis, and some secular texts like Kautiliya Arthashastra. The material remains provide insights into variety of animals that came in contact with human habitations, and about different aspects of faunal utilization. It also provides information on ritualistic and religious significance of certain animals. Literary refences also cover these aspects along with, practices, traditions, beliefs, and myths associated with animals. As both these sources have their own unique strengths, such correlative work can throw more light on material evidences. This can lead to further in-depth study in archaeozoology.

Keywords: *'sanskrit', 'literary sources', India*

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POSTER PRESENTATIONS

Examining the environmental adaptation strategies during the Chinese Neolithic period in the lower Yangtze River alley through the faunal materials from the site of Tianluoshan (7000-5500 cal BP)

The Lower Yangtze River Valley in China has been recognized as one of the earliest centers of rice cultivation and animal domestication in the Neolithic period. The site of Tianluoshan (7000-6000 cal BP), located in Zhejiang, China, represents one of the major early rice cultivation societies. The wetland nature of the site provides a favorable condition for the preservation of a large amount of organic remains, particularly faunal materials, allowing for an in-depth study of the human-environment relationship during the Neolithic period. The core research locality of zooarchaeology in China traditionally centers on the Yellow River Basin while the Lower Yangtze River Valley continues to be an understudied region. This poster presents the partial results of the faunal analysis, the newly elicited research questions based on the analysis, and possible solutions to our understanding of the site and its relationship with other sites in the Lower Yangtze River Valley. We discuss how the discovery and identification of previously undermined and understudied species in Chinese zooarchaeological reports such as snakehead (Channidae), rails (Rallidae), sika deer (Cervus nippon) and water buffalos (Bubalus sp.), can be utilized to answer questions related to the fluidity of the human-animal relationship in the midst of changes in the natural and cultural environments such as season, climate, and cultural interactions. We also propose a new model, based on the results from Tianluoshan, for discussing the Neolithic environmental adaptation strategies in China and East Asia.

Keywords: *Tianluoshan, Lower Yangtze River Valley, rice-cultivation society, environmental adaptation strategies*

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The hunting strategy in the Hoabinhian period of Northern Vietnam

The Hang Cho is a limestone cave in the Hoa Binh province of the northern Vietnam. This cave site was excavated from December 2004 to February 2005, and yielded a lot of stone tools and numerous animal bones of the Hoabinhian culture of hunter–gatherers, from late Pleistocene to early Holocene. The excavated sediments were sieved through 5 mm mesh, and tiny animal remains were collected. The faunal assemblage of the unearthed animals consisted of various mammals, including large and small deer (several species of Cervus sp. and Muntiacus sp.), water buffalo, serow, wild boar, rhino, bear, hog badger, small-clawed otter, weasel, large Indian civet, common palm civet, wildcat, leopard, squirrel, bamboo rat, Malayan porcupine, bush-tailed porcupine, mouse, bat, hare, macaque, and gibbon, a certain amount of land turtles, a small number of birds and fresh water fishes. The habitats of these animals were widely different, such as forest, grassland, watered places in lowlands, and mountain range: which indicates that the occupants of Hang Cho site utilized a diverse range of environments for hunting. Here, we provide quantitative information on the Hang Cho animal bones,

and attempt a brief discussion on the hunting strategy in the Pleistocene–Holocene transition of northern Vietnam.

Keywords: *Hunting strategy, Hoabinhian culture, Pleistocene–Holocene transition*

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General Session:

Worked bone

ORAL PRESENTATIONS

The osseous industry from El Pirulejo (Cordoba, Spain) during the Heinrich Events 2 and 1 and the Younger Dryas

El Pirulejo rock shelter is an Upper Palaeolithic archaeological site located in Priego de Cordoba, Southern Iberia. The human occupation at the site is represented by human bones, lithics, fauna and bone tools. The material culture of El Pirulejo was recovered from the Bronze Age, Magdalenian, and Solutrean layers until now since the site was not fully excavated. The osseous industry from El Pirulejo was dependent on the relationships between mammal species hunted by the hunter-gatherer groups living in Southern Iberia and the several climatic events that affected this region during the Pleistocene, like the HE2 and the end of the LGM, and the HE1 and the YD. These climatic events had an influence on the hunting strategies and in consequence, had also an influence on the kind of tools manufactured by the groups of hunter-gatherers. We present here the osseous industry recovered from the Solutrean and Magdalenian layers, which document several categories of tools and diverse manufacturing and modification techniques and the use of mammal bones and Red deer antlers.

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Bone points from Northern Australia in social and environmental context

Bone points from Arnhem Land in Australia's Northern Territory have an antiquity of at least 8000 years. It has been argued that people changed the way they used these artefacts against the backdrop of significant landscape change. Previous studies have explored connections between bone points and subsistence practices: an increase in bone points during periods when varied floodplains were prolific has been linked to an increase in fishing, suggesting the use of bone-tipped spears for that purpose. In the near-absence of dedicated use-wear studies aimed at bone tools from this region, my project turns the microscope onto bone points from the Madjedbebe rock-shelter located in Kakadu National Park. This site has recently gained international attention for setting a new minimal estimate for initial human occupation in Australia to at least 65,000 years ago, making it the oldest site in the country to date. There are also important revelations to be found within the last 12,000 years of occupation at Madjedbebe. People living here had to contend with increasingly unpredictable climates, changes in population, and shifting access to resources in a transitioning landscape. People adapted to these challenges in several ways, including by altering their stone toolkits. It has been so far unclear precisely how bone technology fits within this scenario. The present analysis indicates that the use of such implements is more complex in the region than previously explored, adding much-needed data to the story of technology change and the role of perishable materials within past ways of life.

Keywords: *Bone tools, Australia, environment, Holocene*

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The exploitation of hard animal materials in Iran during the early Holocene: First elements of characterization and perspectives of research

This paper aims at contributing to the definition of techno-economic aspects concerning the Iranian populations of the early Holocene. In particular, it focuses on the relationship between prehistoric populations and animals through the study of worked hard animal matters, identifying the modalities of acquisition, transformation and utilisation of these raw materials. Though recently there has been an increase in studies focused on ornamental objects in this region, no technological and functional approaches are systematically applied for the study of hard animal materials. As such, after conducting a literature review regarding the exploitation of these raw materials, we present some technical and economical elements of characterization concerning the transformation of osseous and shell materials. The presence of turtle as well as antler and shells remains attests the exploitation of wild species in parallel with the transformation of domestic taxa. The study of osseous artefacts suggests the use of two main ways of transformation in the debitage phase: the bipartition and the fracturing method. These methods enable the production of flat and elongated blanks, subsequently transformed into final objects, mainly pointed objects, during a shaping phase. Several fragments of bivalves, a pearl obtained on bivalve and a gastropod of the Cypraeidae family suggest the transformation for direct shaping of the shells.

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POSTER PRESENTATIONS

The Lower Palaeolithic metapodial hammers of Schöningen

Bones tools have been used by hominids for over one million years and are found in a wide variety of shapes and sizes. The ascribed functions range from probing for termites (Blackwell and d'Errico 2008) to flint knapping (Van Kolfschoten et al. 2015) and from mimicking flint bifaces (Boschian and Saccà 2015) to scraping hides (Soressi et al. 2013). Here, a new type of bone tool is presented: metapodial hammers. The late Lower Palaeolithic site of Schöningen 13 II-4 (MIS 9) is most well-known for its collection of complete wooden spears (Thieme 1997). Although the spears might explain how at least twenty horses were killed (Van Kolfschoten 2014), they do not clarify how 74 long bones of horses were fractured (Voormolen 2008). As only a few large stones have been found (Van Kolfschoten et al. 2015), it has been questioned what other objects could have been used. During the first in-depth analysis of the faunal assemblage of Schöningen 13 II-4, Voormolen (2008) noticed unusual flaking and pitting damage on the distal condyles of several metapodia. He ascribed these traces to stone tool production or curation, but a re-examination found no traces of flint in the battered surfaces (Van Kolfschoten et al. 2015). An explanation for the damaged epiphyses might lie in an observation by Binford (1978); the Nunamiut frequently used reindeer metapodia as hammers in order to fracture other long bones. Experiments carried out in this study confirm that the metapodial hammers from Schöningen could indeed have been used to break marrow-bearing bones. Key words: bone tools, experimental archaeology, bone marrow exploitation.

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A Mudéjar bone tool workshop (13–14th century AD) in Lisbon, Portugal

The emergency excavations that took place in 2012/2013 for the reconstruction of the Largo da Severa, located in the Mouraria (Moorish) neighborhood in Lisbon, uncovered several medieval contexts (11–14th centuries). These correspond to one of the rare Mudéjar contexts in Iberia (i.e. Moorish people who remained in the territory after the Christian Conquest but were not converted to Christianity). The contexts yielded a diversity of materials, including pottery and faunal remains. In one of the archaeological units, a bone tool workshop was identified. A radiocarbon date for these materials resulted in 1286–1398 cal AD. The collection (ca. 160 pieces) is relatively homogeneous. Most of the materials were made from metacarpals and metatarsals of bovids (Bos taurus) and seem to correspond to the earlier stage of the chaîne opératoire: blanks, preforms and debris. Comparing there are only a few possible finished objects.

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6TH SEPTEMBER
THURSDAY

Session title:

The archaeology of human impact on faunas: Between historical and biological sciences

Session abstract:

Archaeological sciences and especially zooarchaeology have demonstrated their relevance to address the impact of humans on past aquatic and terrestrial faunas. This impact leads to the modification of faunal communities which is driven by a wide diversity of phenomena like introduction or extinction/extirpation of species, and erosion of the genetic or morphological diversity of taxa. The archaeological record is crucial to understand the slow mechanisms leading to the alteration of faunas as well as the environmental impact of past human populations in the light of the archaeological record. This kind of research is of special interest in the context of the current sixth mass extinction crisis, and is a good opportunity to generate exchange between zooarchaeology and other scientific fields like ecology and evolution sciences.

This session seeks to discuss methodological questions and to present study case concerning every aspect of human impact on past wild fauna.

Communicants working on all taxa and regions of interest for these questions are welcome in order to generate fruitful discussions about global trends observed in the archaeological record as well as current and future evolution of this field of research. Transdisciplinary approaches are especially welcome. Studies of modern faunas that can be used as model for the study of past assemblages are also relevant.

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ORAL PRESENTATIONS

The tale of Père David's deer: Zooarchaeological records and conservation

Père David's deer (Elaphurus davidianus), also known as Milu deer, is endemic to the Chinese region. It was first introduced to Western science by Père Armand David, a French missionary, in 1866, when it was already endangered. Soon, Milu deer disappeared from China. The present population of all Milu deer are offspring of the 18 deer from Woburn Abbey in England. Therefore, the indigenous habitat of this species can only be learned from fossil records and their morphological features.

Fossil records reveal that Milu deer first appeared during the Pleistocene period. According to archaeological evidence, Milu deer used to be wide spread across Chinese region, not only in the Southern area where they are inhabiting, but also in the Yellow River region in the North, especially during the warm period in Holocene. Hence, it has been an important prey animal for human beings since the Neolithic period. This paper summarizes the archaeological records of Milu deer, and discusses its close relationship with human. In addition, Zooarchaeological research contributes the biological study and conservation of this species. The successful reconstruction of Milu deer's habitat sheds light on the study of other endangered animals.

Keywords: *China, cervids, historical biogeography*

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Marine turtle consumption in the Mediterranean: From ancient taboo to conservation management

Remains of marine turtles occur regularly in the archaeological record. They provide insights into ancient subsistence and community practices. They also contain crucial information that can be used to create baselines for conservation. Their explanatory power is increased when the species exploited are identified. Here we describe an osteomorphological method which allows us to analyze fragmented postcranial elements of common Cheloniidae (*Caretta Caretta* and *Chelonia mydas*) to species and reconstruct species-specific exploitation patterns. We focus on two case studies from the Eastern Mediterranean (Turkey and Lebanon) which demonstrate that humans were selective in which sea turtle species they exploited. These multi-period case studies, in combination with published information about marine turtle exploitation in the region, also indicate long discontinuities in the archaeological record, which may be related to food avoidance. Size and sex reconstruction point at differing capturing techniques. Results have interesting implications for understanding human-marine turtle interactions with deep-time perspective.

Keywords: *Marine turtle, Eastern Mediterranean, marine turtle exploitation, human-marine turtle interactions, marine conservation management*

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Exploitation of terrestrial herpetofauna in Guadeloupe islands by Amerindian Pre-Columbian populations

The question of the exploitation of small terrestrial taxa by ancient human populations can be challenging to address from a zooarchaeological point of view because their remains can be the reflection of processes unrelated to human behaviors. In addition, they represent a minor part of the faunal assemblages and they are thus often understudied. This remark is especially valid for reptiles and amphibians taxa which are especially scarcer in temperate regions where the zooarchaeological methodologies were first developed. Such taxa can however be of good archaeological interest in tropical regions where they are far more represented should they be properly investigated.

That is what I try to demonstrate by presenting an exhaustive zooarchaeological study of the archaeological terrestrial herpetofauna collected from 20 archaeological deposits in Guadeloupe Islands. The aim is to provide new data concerning subsistence strategies of hunter-farmer-gatherer pre-Columbian Amerindians during Saladoid and Troumassoid periods (2200-500 cal. BP).

Obtained results indicate that although a strong inter-site variability can be observed, Guadeloupe pre-Columbian groups rarely rely on terrestrial herpetofauna for meat intake. Moreover, they seem to consume a very limited number of taxa in comparison to the large diversity of preys available on the investigated islands. Zooarchaeological evidences also reveal that some of the occurrences of terrestrial reptiles in archaeological deposits could rather reflect animal synanthropic behaviors than their exploitation by Human societies. On a broader perspective, the data show the minor impact of Pre-Columbian inhabitants on Guadeloupe terrestrial ecosystems contrasting with what happened subsequently to the 16th century and the European colonization these islands.

Keywords: *Caribbean, Squamate, human impact, Amerindian*

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Reflexion toward the southern expansion of the wild turkey and the reality of the South Mexican subspecies: How can we differentiate natural range from human-mediated dispersion?

The wild turkey (*Meleagris gallopavo*) ranges from Southern Canada to Central Mexico, but the identification of the southern limit of its expansion is still subject to debates. On one hand, wild populations are considered extirpated in much of Central Mexico since the beginning of the 20th century, preventing a direct population survey. On the other hand, turkeys have been intensively managed and translocated by human populations since at least the beginning of our era, scrambling the paleontological and historical interpretation.

While stable isotopes, and in particular 13C ratios, have proven to be a valuable tool in the identification of captive turkeys in ancient America, their use in the reconstruction of natural range vs. human-mediated dispersion is limited by the potential existence of (1) individuals raised in free-range practices and (2) descendants of translocated birds which escaped and adapted to live as wild in a new region (“maroon” turkeys).

Through the examination of genetic data from modern and archaeological populations, this communication will review the definition of the three Mexican subspecies and their natural distribution. The identification of the South Mexican subspecies will be questioned considering the limited paleontological evidence and its genetic proximity with another subspecies, the Rio Grande turkey. Human impact on both the distribution of the populations and the genetic diversity will be considered. Overall, this presentation will stress the difficulty in reconstructing turkey’s natural range in Central Mexico in spite of its interest to better understand past human activities and to evaluate the recent erosion of the local biodiversity.

Keywords: *Meleagris gallopavo, aDNA, population genetics, zooarchaeology, domestication*

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Morphological diversity of modern and past domestic equids: Complete skeletons as a marker of function and cultural practices

Equids and humans share a long history of interaction from the first domestication to the standardization of modern breeds. In order to suit human activities, horses have been shaped through selection for aesthetics, gaits, or performance. This artificial selection is known to have largely impacted morphological and functional traits, producing the large range of current breeds. In spite of being generally the last direct testimony of morphological traits, archaeological bone remains are generally under-explored, contributing to our poor knowledge about past horse phenotype and usage. Here, we develop approaches allowing the characterization of the morphological and functional diversity of domestic equids, using 3D geometric morphometric methods. Taking advantage of the fact that horses, because of their particular status for human societies, are often found as complete skeletons in archaeological sites, we will not only study shape variation of individual bones, but also shape covariation between them. Indeed, exploring covariation patterns may allow addressing functional questions which are of great interest concerning taxa known to be largely selected on performance and usage criteria, such as horses. Our results show that this kind of approach has a great potential in studying the impact of artificial selection on horse phenotypes. Investigating their bone shape variation and covariation could indeed help to enrich our knowledge about breeding practices and past use of horses. Moreover, it can contribute to enhance our understanding of micro-evolutionary processes, such as artificial selection, on domestic taxa and through that, gain insights into how phenotypic diversity is produced.

Keywords: *3D geometric morphometrics, artificial selection, domestic equids, functional morphology, morphological integration*

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Sus 100: Osteological morphological variation in pigs associated with the development of industrialised pork production in twentieth century Germany

Sus 100 is an interdisciplinary project that synthesizes the methods of biology, livestock science, and archaeological science within a social framework to evaluate the biological effects of human driven selection pressures upon the modern domesticated pig. These measurable selection pressures, such as human dietary preference and agricultural efficiencies, characterise the modern industrialised meat production industry. However, the responsiveness of the osteological frame and genome to these ephemeral productive characteristics has yet to be described.

Modern and historical specimens dating from the turn of the last century from two key pig breeds, the Deutsch Edelschwein and the Deutsch Landschwein, are compared with wild boar remains which were collected from German forests. Variation in skeletal morphology between breeds and historical and modern populations is measured using three-dimensional geometric morphometric methods. The first results from this analysis are presented here to evaluate the speed and responsiveness of the osteological frame to these pressures. This project acts as a modern case study not only to model the responsiveness of the Sus scrofa to evolutionary pressure but also to evaluate osteological response to intense culturally-driven human selection upon past animal populations.

Keywords: *Pigs, geometric morphometrics, DNA, selection pressure, animal breeding*

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DOMEXP: Towards new morphometric markers of the domestication process

The domestication process remains too elusive to be documented from the domestication syndromes commonly used in zooarchaeology. These morphological syndromes mainly rely on genetically driven morphological markers induced by adaptation and directional selection. They document the occurrence of a domestic animal in the archaeological record but not the domestication process of a wild one. Furthermore, gene flow during the domestication process has likely delayed the expression of these domestication syndromes, preventing the zooarchaeologists to explore the earliest stages of the domestication process.

DOMEXP research project explore the imprint of the environmental stress of the domestication process in the animals' bones. We have first focused on the biomechanics stress induced by the captivity. The plastic imprint and developmental process induced by captivity was investigated through and experimental design on an ungulate model: the wild boar (*Sus scrofa*). Longitudinal study of the skeleton development of individuals from the same population that grew in different levels of mobility reduction was captured through CT and MRI. We combined both 3D Geometric Morphometrics of bone surfaces and 3D morphometric mapping of the cortical thickness of long bones to capture the biomechanic signal of captivity and explore this signal in the archaeological record.

Keywords: *Domestication, geometric morphometrics, captivity*

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Session title:

Zooarchaeology for global challenges

Session abstract:

Today, the world is under pressure from a rapidly increasing human population and the associated environmental impact of husbandry regimes, including not only the intensification of food production, but effects from urbanisation, globalisation, climate change, disease transmission and inter-cultural conflict. Modern intractable problems, as identified in the United Nations' Sustainable Development Goals, have implications for human-animal-environmental health and well-being, and yet these are not exclusively modern phenomenon.

There is growing awareness that (zoo)archaeological perspectives can not only contextualise present day problems, but also inform current policy and mitigation strategies. However, zooarchaeologists are only just beginning to contribute to this agenda, despite the field being uniquely placed with access to large quantities of human-animal-environment data that can be analysed using a variety of arts and science-based techniques to unpick and model long-term bio-cultural dynamics. This potential has not been realised because zooarchaeology has traditionally been a backward-looking discipline, concerned only with the past, with a fractured approach. For instance, research is generally compartmentalised by temporal/geographical focus and divided by methodology (e.g. traditional zooarchaeology and biomolecular analyses – genetics, proteomics, isotopes). But examples of increasingly multidisciplinary research have shown how deep-time data can be collated, considered, and presented in a way that can help address modern global challenges.

This session calls for papers that demonstrate how by studying the diverse inter-relationships between humans, animals and the environment it is possible to both obtain a better appreciation of past societies and also to inform on the lives and habitats of those in the present.

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Keynote speech:

Humanity's best friend: A Dog-centric case study of a human-animal-environment approach to address global challenges

The importance of addressing the Global Goals set out by the United Nations cannot be overstated, but current approaches for achieving long-term sustainable solutions have been widely critiqued. Generally coming from the field of international development, which is the product of Western belief systems, strategies are often anthropocentric, whereby humans are conceptualised as separate from the natural world. As such, research agendas have prioritised narrowly focussed scientific investigations, even though it is clear that many global challenges are highly interconnected and critically entangled with socio-cultural ideologies of deep history.

To address this, in 2017, the Annenberg Foundation hosted a transdisciplinary workshop to develop a new approach to humans-animal-environment relationships. Using the dog as an exemplar, it highlighted how detailed single-species studies can become the foci for highly interdisciplinary approaches to Global Challenges. This paper reports on the key findings from the workshop and will make available the White Paper that derived from it.

Keywords: *Dog, wildlife management, human-animal health*

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ORAL PRESENTATIONS

Investigating the environmental impact of domesticated animals on Northern and Central European forests during the early Neolithic

European forests were radically reshaped by the arrival of non-indigenous plant cultivars, animal domesticates and farming practices from Anatolia and the Near East eight thousand years ago. Historically stock herders have used trees to provide shelter and fodder in the form of leaves, bark and small twigs during winter periods or to prevent overgrazing. These practices are now in decline due to the introduction of alternative winter fodder and loss of knowledge to maintain these human-induced environments. Considerable attention is now focused on improving foddering systems by increasing forest component for several reasons, such as a method to increase biodiversity on farmland and mitigate climate change, and the potential benefits to livestock well-being and productivity in line with UN sustainable development goals 2015-2030. Here we discuss the use of forests for grazing and fodder sources during the early Neolithic from a stable isotope perspective. In general, the leafy forest contribution was low to the cattle diets but in respect to other domesticated species, cattle were pastured in forests which would have had an impact on the density and composition of forests by creating trackways and preventing regrowth. The study highlights the potential that multi-proxy archaeozoological research can be used to investigate the environmental impact of early Neolithic domesticates and how it can be used to help future stockherders develop sustainable foddering practices.

Keywords: *Livestock, forest pasture, leafy hay, sustainable foddering*

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"Herding this camel or leaving this land?" Interim assessment of a small-scale archaeological animal culture project in western Turkey

There is a change in present human stance towards animals with growing ethic, moral and sentimental attitudes. Remarks and criticism on specific human-animal-related behaviour is spread and widely visible through social media. The emergence of omnipresent public opinions generated scientific and philosophical interest in the origins of human-animal relationships. The role of zooarchaeology, in combination with other sources, lies in providing a nuanced and detailed image of past human-animal relations and in offering a 'thick description'. Additionally, zooarchaeological literature about changing relationships with animals in the past should be promoted, and made accessible for a wider audience, including policymakers. To enter the Anthropocene debate, different disciplines such as philosophy, economy, biology and anthropology should be mobilised alongside zooarchaeology in order to form a significant voice. Many of us would agree with these statements.

However, how do we put theory into practice at the field when the terrain is rough? In this paper, we discuss this question in the context of the Hidden Hybrids project, funded by the Wenner-Gren Foundation. Hidden Hybrids: Camels and Cultural Blending in the Ancient Near East seeks to trace the origins of intentional crosses between dromedaries and Bactrian camels in the archaeological record. It uses a series of cutting-edge methods including ancient DNA analysis, and traditional ecological, economic, and cultural knowledge obtained from camel owners in Western Turkey. Our

informants also make up our (ideal) target audience in our ambition to make a difference for them and for camel culture in Western Turkey. Here we focus on the challenges we encounter on our pathways to impact in this unique cultural context.

Keywords: *Hybrid camels, public opinion, thick description, cultural knowledge, Western*

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Knowing the past to empower the present in herding communities of Antofagasta de la Sierra (Southern Argentine Puna)

Antofagasta de la Sierra is a small town in the Southern Argentina Puna, in a region known for its extreme aridity. Zooarchaeological studies demonstrate that South American camelids were a key resource in the development of Andean societies in the region, from early hunter-gatherers through to later pastoralist groups.

Although pastoralism continues as the main economic activity of the area, the fundamental role played by the llama (*Lama glama*) has declined due to a variety of factors, including work migration to cities, and the insertion of exotic animals into local herds. This has led to different challenges, such as the negative environmental impact caused by the introduction of foreign, ill-adapted species –vis-à-vis camelids– into fragile ecosystems such as the puna. This goes hand-in-hand with a concomitant loss of ancestral knowledge in respect to camelid management.

Nevertheless, this process is happening at the same time as a more general, positive change towards the autochthonous camelid and the ethnicities underpinning it is occurring. This change is influenced by a growing local affluence linked to tourism.

Here, we present the first steps towards a collaborative strengthening of the links the community maintains with its cultural tangible and intangible heritage. Our aim is to generate participative strategies that allow for the sustainability of cultural and natural resources through active engagement with, and by, local agents. We maintain that heritage training and education are the key to the future continuity and success of these activities. Crucial to all this is an understanding of past camelid herding.

Keywords: *Camelids, herding, heritage*

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Lessons from the past: Zooarchaeological analysis of broad spectrum diet (BSD) and sustainability at prehistoric Kumeyaay village sites in coastal San Diego, California

Zooarchaeological studies of three coastal Native American sites in San Diego, California yielded ca. 100 animal taxa in each site. Small mammals (e.g., leporids and rodents) and fish (e.g., clupeids) predominate the bone assemblages. The diet was supplemented by amphibians, reptiles and birds. The wide array of taxa reflects utilization of diverse marine and terrestrial habitats indicating that BSD was a long-term subsistence strategy in these villages. Small mammals comprise the vast majority of species by NISP. Long bones and axial skeletal elements of medium and large mammals (e.g., deer, sea otter) were fractured and pulverized for bone marrow and grease extraction, and later for bone tool manufacturing resulting in underrepresentation of these species in the zooarchaeological record. All animal products such as meat, bone, fur and hide were fully utilized and recycled. Exploitation of diverse habitats and optimal utilization of animal products point to a highly adaptive behavior. Lessons from the past: the Kumeyaay people sustained themselves for over 10,000 years without exhausting the environmental or depleting their subsistence resources.

Keywords: *Broad spectrum diet, sustainability, optimal foraging theory, California*

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Fair game: Exploring the dynamics, perception and environmental impact of wild foods

Food security and sustainable over-production are prime concerns for governments worldwide as they struggle with the economics and environmental impact of providing sufficient sustenance to feed a growing human population, estimated to reach >9 billion by 2050. In order to meet global demands, attention has focussed on increasing the productivity of a narrow range of domestic animals (e.g. cattle, sheep, pigs, chickens) with species transported from one country to another, being farmed intensively (often unsustainably) in regions far beyond their native range. However, it is becoming apparent that a key to food security may be for humans to tap resources that are already plentiful but, due to cultural taboos, are considered 'unedible'.

In England, for instance, there are large and rapidly increasing populations of wild animals. These have been highlighted as a threat to the production of agricultural surplus and to food security because they cause millions of pounds of crop damage annually. In this case, it might be argued that game should contribute more to the human diet. However, government documents highlight a "prevailing negative attitude towards game meat amongst the general public" (Postnote 325; 2009). That such an opposing cultural stance can have developed when, in the past, they were a key source of human protein reveals the plasticity of attitudes to food in general and to wild resources in particular. This paper sets out to explore the bio-cultural dynamics responsible for these shifts with the aim of transforming human attitudes to game in the present.

Keywords: *Wild animals, food security*

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Tracking ancient animals to provide an archaeological perspective on wild mammal management, conservation and 'rewilding'

Human immigration and biological invasions are high-profile topics in modern politics, but neither are uniquely modern phenomena. Migrations of people, animals and ideas were common in antiquity and are frequently incorporated into expressions of cultural identity. However, the more recent the migration, the more negative modern attitudes are towards them. In general, native is perceived as positive and 'natural', whereas the term 'alien' is attached negatively to both cultural and environmental problems. Furthermore, decisions about conservation and management are often driven by a species' perceived native or alien status. The zooarchaeological record offers the potential to establish the bio-cultural history of wild mammal species and model the dynamics of these human-animal-environment relationships over millennia.

Using the Easter festival and its associated animals as a case study, this paper will explore these value-judgements by integrating the use of scientific approaches (genetics, GMM and isotopes) with evidence from traditional (zoo)archaeology, art history, and citizen scientist initiatives to investigate the human-mediated dispersal of the brown hare and rabbit in connection with the Easter festival. We argue that the cultural and temporal context of these 'alien' introductions are key factors for both understanding the origins of Easter and for challenging widespread negative attitudes towards cultural and biological 'aliens'. Furthermore, we demonstrate how archaeological studies that integrate faunal remains analysis with genomic and isotopic approaches can provide the evidence base upon which modern conservation policy can be built.

Keywords: *Alien species, wildlife management, shifting baselines*

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Policymakers should rethink 'wildness' as a principal criterion for conservation in the light of new zooarchaeological and ancient genomic perspectives: The Przewalski horse case study

Policies, and sometimes even laws, place a strong emphasis on wildness as a key criterion for conservation status and which animals can be released into the environment as part of re-introduction programmes. However, archaeologists and ancient geneticists are increasingly finding that many species and environments are not as 'pristine' as once assumed. The present is a poor guide the complex history of plant, animal and human niche construction, and it is becoming clear that modelling from modern genetics alone is deeply flawed. Furthermore, the quasi-moral judgment that wild lineages should take precedence for conservation does a disservice to biodiversity, when the lineages of so many wild and domestic breeds are under equal threat. As such, rather than focussing on a flawed wild/domestic dichotomy, conservation policy should consider cultural, ecological and biological heritage without prejudice.

This paper uses the Przewalksi horse as a case study. Found living in the wild in Mongolia the 19th century, the Przewalski horse went extinct in that habitat in the 1960's and survived only in zoos. Assumed to be the only true wild horse it was re-introduced to Mongolia and has been a successful conservation story. However, recent archaeological and ancient genomic evidence shows the Przewalski to be the feral direct descendent of the earliest known domestic horses of the Botai Culture of Northern Kazakhstan, 5,500 years ago. Since the Przewalksi horse represents a distinct lineage, its ferality should not undermine its conservation status. Indeed, their unique cultural heritage makes these horses all the more important and interesting.

Keywords: *Conservation policy, wild, feral, Przewalksi's horses*

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Neglected zoonotic diseases ancient and modern: Brucellosis and human-animal relationships in long-term perspective

Today, zoonotic diseases represent some of the greatest health challenges facing the world, with some 60% of human pathogens and 75% of emerging or reemerging diseases being of zoonotic origin. 'Neglected zoonotic diseases' are a group of infections that disproportionately impact the world's most vulnerable populations, particularly those living in close proximity with their animals and who have less access to health information and care. The history of the development of these diseases is also neglected, particularly in terms of knowledge on evolving human-animal relationships, with implications for understanding of long-term trajectories. In this paper we consider zoonotic brucellosis in archaeological perspective, with a focus on the relationships between humans and goats. Brucellosis, today's commonest bacterial zoonosis worldwide, likely emerged as a zoonotic disease with caprine farming, yet evidence is elusive in the archaeological record. We explore the potential impact of goat domestication on zoonotic brucellosis disease dynamics and human infection risk. Results are presented of a model developed to simulate the transmission of *Brucella melitensis* within early domestic goat populations in the Early Neolithic Zagros mountains. These show that the pathogen could have been sustained even at low levels of transmission within these populations and also inform on the cultural practices that may have contributed to this. We evaluate our results within the context of holistic 'One Health' views of the complexity of zoonoses and consider how archaeology can contribute long-term perspectives to the health impacts of current trajectories.

Keywords: *Zoonoses, domestication, Brucellosis, One Health, emerging disease*

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Tackling human health and wealth in the Horn of Africa through archaeogenetics and epidemiology of faunal remains: An introduction to the HORN project

The GCRF-funded project 'One Health Regional Network for the Horn of Africa' (HORN) aims to improve the health and wealth of people living in the Horn of Africa (Kenya, Ethiopia, Eritrea and Somalia) by increasing the local capacity to undertake high-quality research on local people-animal-environment interactions. An important integration to this global challenges-tackling project is the temporal dimension, provided by zooarchaeology and ancient genetics. The development of Next Generation Sequencing and DNA hybridisation enrichment has unlocked our access to ancient high quality sequences and increased our time depth limit for DNA retrieval. Equipped with such data, recent studies have plunged deeper into questions on rapid evolutionary changes, domestication, climatic adaptation and epidemiology, all of which have had an impact on decision-making for social, economic and health developments.

From an archaeological perspective, we aim to i) recover old strains of diseases to understand the evolution of targeted viruses and map out the mutations of viral strains in response to vaccine development, 2) recover ancient microbiomes based on dental calculus and 3) detail our cultural understanding of local human-animal health relationships and medicinal customs. Through capacity building and the training of local academic researchers, we aim to improve agricultural systems, increase food supply and reduce malnutrition, provide more financial resilience, and better the detection, diagnosis, prevention and control of diseases.

Keywords: *Ancient DNA, epidemiology, global challenges, health, chickens*

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Discussion:

Opportunities and challanges of addressing global challanges through zooarcheology Terry O'Connor, University of York, U.K, terry.oconnor@york.ac.uk

Session title:

From macroscopic to molecular methods and techniques: A discussion on tools for the study of archaeofaunal remains

Session abstract:

Several methods have been used in the study of faunal remains from archaeological areas, from the observation of macroscopic diagnostical structures (modern reference collections for comparison with magnifying glass/stereomicroscope, digital microscope), as well as the use of microstructural and molecular investigations (DNA, stable isotopes, microstructural characterization) and their impact on the technical training of human resources for zooarchaeological research. This session aims to promote a broad discussion about the evolution and the use of the various methodologies and techniques employed in animal vestiges analyses at present, which serve as important tools to the knowledge of the various relations between humans and fauna during the time, by the presentation of many case studies.

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ORAL PRESENTATIONS

Preliminary report of strontium isotopic values for six herbivorous species from Cedral, San Luis Potosí, México

At several sites located nearby Cedral, San Luis Potosí, México, there have been evidence for a Late Pleistocene association of human activity and extinct carnivorous and herbivorous mammals, which have been the focus for several archaeological and paleontological studies, including those addressing what species inhabited this locality and were contemporaneous to early human, and also some paleoecological studies using mesowear, microwear and carbon and oxygen isotopes analyses to learn on the feeding habits of those animals, and indirectly, on the environment in which they lived. However, a scarcely studied topic is finding if the species were native o arrived from other areas. For pursuing that objective, the strountium isotopic relationships for dental enamel was utilized for bison, *Bison* sp.; Pleistocene camel, *Camelops hesternus*; Glyptodon, *Glyptotherium* sp.; Pleistocene llama, *Hemiauchenia* sp.; Columbian mammoth, *Mammuthus columbi*; and Pleistocene tapir, *Tapirus haysii*. The 87Sr/86Sr isotopic values for those animals were compared with those obtained for soils from nine localities in San Luis Potosí: Armadillo de los Infantes, Charcas, Cedral, Laguna de las Cruces, Presita Blanca, Los Pinos, Mina de San Antonio, Paso del Águila, Rio Verde, and Tepetate, in order to identify the possible procedene locality for the animals. The results obtained showed that 87Sr/86Sr values of those animals were similar to soil values from Cedral, which indicated those animals were native to the locality, and did not move to other sites in search for food or water.

Keywords: *Cedral, strontium, migration, Late Pleistocene*

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Creation of an osteological Cetacean reference manual

The field of zooarchaeology is concerned with reconstructing human-animal interaction in the past. Cetaceans have been neglected by zooarchaeologists for a long time. This can partly be ascribed to the fact that their remains are often extremely fragmented and there is a lack of high-quality osteological reference collections. These factors render identification to the species level problematic, resulting in a poor understanding of human-cetacean interaction in the past. Recently however, new methods have shed more light on the history of cetacean exploitation, including aDNA research and Zooarchaeology by Mass Spectrometry (ZooMS). For this study, however a more traditional zooarchaeological method to analyse cetacean material was created: an osteological reference manual. Osteological manuals are an invaluable source to zooarchaeologists to help identify zooarchaeological remains to the species level, however one for cetaceans did not exist yet. As part of my research I attempted to create an extensive cetacean reference manual at the Natural History Museum, Smithsonian, Washington DC. The creation of this manual in combination with the recent advancement in ZooMS analysis will hopefully optimize research on zooarchaeological (and palaeontological) cetacean remains and will lead us to reconstruct the early beginnings of cetacean exploitation.

Keywords: *Cetacean, reference manual, aDNA, ZooMS*

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The FINDER Project: Using high-throughput ZooMS to identify fragmented bones at Denisova, Cave and Strashnaya Cave

The FINDER project (www.finderc.org), based at the Max Planck Institute for the Science of Human History (MPI-SHH), aims to taxonomically identify 40,000 fragmented bones from more than 20 Pleistocene Asian sites over the course of five years (2017-2022). The project's main aim is to locate any hominin fragments amongst these faunal assemblages, but the parallel identification of thousands of faunal remains has wide reaching zooarchaeological implications for the studied regions. The amenability of Zooarchaeology by Mass Spectrometry (ZooMS) to high-throughput analysis allows for hundreds of bones, as many as 700-1000 fragments, to be analysed within a week (Brown et al. 2016). Such large scale examination of morphologically unidentifiable bones allows for comparison with those identified using traditional osteological methods for a more holistic picture of the faunal remains present at a site. Here we describe the method and present a comparative study of the fauna identified using ZooMS as well as traditional zooarchaeological methodologies at two sites in the Altai Mountains of Russia (Denisova Cave and Strashnaya Cave). We aim to highlight the complementary nature of using both forms of taxonomic identification and to provide a large dataset of fragmented bones which might be useful for further biomolecular analysis.

Keywords: *Denisova, Strashnaya, ZooMS, collagen fingerprinting*

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Sample now or save later? Destructive sampling of archaeological animal remains

Discussions of the ethical implications of destructive sampling are largely absent in the zooarchaeological literature. Destructive analysis methods such as ancient DNA (aDNA), ZooMS, isotope analyses, and radiocarbon dating are becoming more common. The refinement and rapidly lowering cost of DNA sequencing has led to a fast growth in the field of aDNA studies. Many studies now focus on sampling petrous bones as these have been shown to have the best DNA preservation. Petrous bones are often under-identified during zooarchaeological analysis and it is difficult to estimate their numbers within animal species in a region or time period. Making ethical decisions about destructive sampling must always involve an understanding of rarity as well as the possibilities and limitations of each study. We will present ways to mitigate negative ethical implications of destructive sampling on both a project level as well as propose changes in curation of zooarchaeological collections and the legal and regulatory environment. Zooarchaeologists need to openly discuss destructive sampling both within the discipline and with specialists outside the field, who lead many of the studies which require destructive sampling.

Keywords: *Destructive sampling, ancient DNA, sampling ethics, petrous bone*

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Carbon, nitrogen and oxygen stable isotope compositions of South American camelid bones from the archaeological site of Hornillos, 2 (Dry Puna, Argentina)

Hornillos 2 is a rock-shelter located at the Dry Puna area in the Northwestern corner of Argentina and it presents nine human occupational levels dated to the Early and the Mid-Holocene (from 9710 to 6130 years BP). Abundant bone remains assigned to South American camelids were recovered at these layers and a sample was selected to be the subject of stable isotope analyses. Previous results measured on bone collagen extracted from these materials revealed the absence of significant differences in the d13C values from both chronological periods, although d15N values presented statistically significant differences. This pattern was explained considering the environmental change that occurred during the Mid-Holocene, which led to more arid conditions that modified the nitrogen cycle on a regional scale. In this work, we present new d13C and d18O values measured on bone apatite from the same archaeofaunistic materials, aiming to discuss changes in camelids' diet and mobility and their link to environmental change. Overall, the new results presented here will allow us to discuss the particular characteristics of human subsistence strategies in this area within the South-Central Andes, aiming to understand the development and evolution of the relationship between human groups and South American camelids in a context of profound changes within the Puna ecosystem.

Keywords: *Early and Mid-Holocene, environmental change, bone apatite, subsistence strategies, Puna Highlands*

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Analysing bone microstructure as a marker of animal use and exploitation of first domesticates

Microstructural characterization of bone archaeological remains opens the doors to the study of animal activity patterns and exploitation during Prehistory. Bone growth and development are reflecting a variety of an animals live that can be traced back through the analysis of osteons and differential bone growth. Osteons, as the fundamental functional unit of compact bone allows to gather data about age and sex of the individuals as well as different aspects related to their health, diet, taxonomy or motor history. In a similar way, differential bone growth can also be a reflection of external physical stimuli and the bones' optimal adaptation to these external mechanical forces and thus, an indicator of the animals' activity patterns. In this communication we present an integrated analysis of cattle 3D long bone cross-sections and osteon analysis on cattle metapodials. The aim is to correlate activity and exploitation patterns of this species at the onset of the domestication, comparing management strategies between Neolithic open air and cave sites located in the north east area of the Iberian Peninsula. The obtained results allow us also to stablish a set of referentials with which to evaluate the influence in bone microestructure that variables such as age, sex or use have on animals during their live. With this work we aim to contribute to our knowledge on cattle management strategies and their economic role as well as to evaluate the possibilities and limitations of this methodological approach.

Keywords: *Bone microstructure, analyses, osteon, Iberian Peninsula*

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An overview of zooarchaeological research in Brazil: Multiproxy analyses

Archaeological sites in Brazil have a high concentration of faunal remains and studies have been developing through different approaches and methodologies to enhance understanding of biodiversity, the relations between humans and fauna and the palaeoenvironment. Multiproxy analyses carried out in ichthyology (cranial/postcranial bones, otoliths, and teeth, among others), carcinology (dactyl of crabs) and conchology (shells of bivalves and gastropods) generate long-term perspectives allowing comparisons of the past with the present and, in this way, verifying the environmental changes occurring on a spatial and temporal scale. The objective of this study is to present an overview of zooarchaeological (archaeozoological) research in Brazil, analyzing the methodologies and techniques that have been used, as well as the knowledge advances obtained over time (scanning electron microscopy, stable isotopes, structural characterization, and other).

Keywords: *Zooarchaeological methods, faunal remains, Brazil*

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Session title:

Commensal vertebrates as bioproxies for human processes

Session abstract:

The animals that live amongst us, often unnoticed, have had some of the greatest impacts on human societies, and can provide a rich source of data on human ecology, living conditions, and even economy. Despite this, research within the discipline of zooarchaeology has focused primarily on domestic and hunted species, with relatively little research into the potential for these commensal animals to contribute to our understanding of past human social development and historical dynamics (e.g. communications, migration, urbanisation).

A wide range of taxa have colonised anthropogenic niches in and around human settlements, in some cases resulting in populations dependent upon their association with humans. A striking example of this widespread process has been the spread of commensal species far beyond their original wild ranges as a direct result of their association with humans. This anthrodependency presents a range of opportunities for using the animals in question to track important developments in the human communities and settlement systems upon which these species depended. Rodents—particularly rats and mice—are currently the most commonly discussed commensals in this context, though various other species including insectivores, small carnivores, birds, and even insects also fit into this developing conceptual and analytical framework, in different times and places.

This session showcases research in which evidence related to commensal animals—broadly defined—serves as a proxy for (pre)historical processes: from sedentism and food storage, through living conditions and urbanism, to migration and trade contacts. We welcome papers that address these issues in different periods and world regions, using any relevant taxa.

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ORAL PRESENTATIONS

Reconsidering concepts of cultural selection in early domestication with an appeal to the commensal model

Research on the origins of animal domestication has relied heavily on the use of concepts of cultural selection and allied methods which are based on morphometric characteristics of skeletal remains as diagnostic markers for important shape and size changes in the domestication process. Indirect selection mechanisms, and in particular those of commensal pathways to domestication, have often received less attention. As a result, it has recently been argued that previous attempts to pinpoint the timing and geographic and cultural contexts of initial domestication should be questioned. This new approach is supported by empirical findings from geometric morphometric studies of phenotypic variation in key diagnostic traits in dogs and pigs, DNA research, and theoretical thinking from the perspective of niche construction and the extended synthesis of evolution.

A step in this direction is provided by recent work on the house mouse and the context of its initial commensal bond with pre-agricultural hunter-gatherers in the southern Levant. In this study, hunter-gatherers with reduced-mobility strategies of settlement and subsistence unintentionally altered competitive interactions among different species of mice, leading to habitat partitioning and the initial colonization of commensal habitats by the house mouse. Indirect human provisioning of food and shelter for mice in newly created anthropogenic environments around more sedentary occupations also exerted new forms of selective pressures favoring one species of mouse over others.

This work offers important insights into early human-animal interactions, and calls for rethinking of current approaches to documenting early domestication pathways and ways of addressing pressing issues in the how and why of domestication origins.

Keywords: *Niche construction, Mus musculus, house mouse, domestication pathways**,** Levant*

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New evidence for the role of Natufian sedentism in house mouse commensalism

The house mouse is probably our most successful commensal and one of the most threatening invasive mammals to biodiversity. Until recent advances in bioarchaeology methods, the origin and dispersal of this elusive mammal and the history of its co-evolution within the human niche construction was highly speculative. Here, we would like to review our latest understanding on the origin of its commensal relationship with humans and the pace and vectors of its dispersal through western Eurasia; bringing together zooarchaeology, ethnozooarchaeology and evolutionary biology.

Keywords: *Mus musculus, niche construction, anthropogenic dispersal, Levant*

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Fox overabundance and early sedentism in the Near East

Ethological and ecological studies point to the proliferation of small mammalian carnivores, most notably red fox (*Vulpes vulpes)*, in human-modified environments. Foxes prey on human trash and consequently their populations in and around settlements are denser, their survival rate is improved and their foraging territories contract, centering on refuse dumps. This carnivore overabundance leads to a series of effects on the local ecosystems. The foxes' strong commensal relationship with humans highlights the unintentional but highly effective alteration of the ecosystem by human communities. Here we investigate archaeologically when and how the impact of human settlement refuse started to significantly affect the local fox populations. We also examine humans' response to this phenomenon, using the rich evidence from the 11,600-year-old early sedentary foragers' community of Hallan Çemi (Turkey). Fox overabundance and commensalism are evident as early as the first permanent hunter-gatherer settlements appear in the Near East, ca. 15,000 years ago, preceding the appearance of

agricultural villages. Fox demography and body-size support the overabundance scenario, while, consequently, humans habitually used foxes as resource. Thus, terminal Pleistocene and early Holocene hunter-gatherers unintentionally created an overabundance of foxes and then managed to use this side effect of sedentism to their favor, by including foxes in their broadening subsistence base.

Keywords: *Vulpes vulpes, Anatolia, Terminal Pleistocene, Early Holocene, settlement*

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Outfoxed: Exploring the phenomenon of the 'urban fox'

While many terrestrial species have been forced to retreat to ever more remote spaces in the face of urban expansion, the red fox (*Vulpes vulpes*) has adapted successfully to contemporary sub-urban and urban environments (Bateman and Fleming 2012). The number of foxes occupying British cities is difficult to assess but has increased considerably over the past few decades (Harris and Baker 2001); some estimates suggest a population of c. 35,000.

Given the fox's ability to adapt to diverse habitats around the world, it is surprising that urban fox populations are only thought to have expanded in the latter half of the mid-20th century. Several explanations for the sudden increase in numbers have been given, but one of the most intriguing has been O'Connor's (2013, 72) suggestion that prior to the control of feral dog and cat populations, foxes were outcompeted in urban spaces (O'Connor 2013, 72). This talk will present a pilot study that systematically gathers archaeological evidence of foxes (their bones) from England from the Iron Age to the present, to test whether urban foxes really are only a 20th-century phenomenon and, if so, explain the reasons why they were not present in towns and cities beforehand.

Keywords: *Vulpes vulpes, urbanism, England, feralism*

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Teaching old data new tricks: Phenotype affinity among canidae skulls

Novel traits among canid groups in an area reflect the movements and interactions of peoples and their quadrupedal companions across the paleoenvironment. Tracking changes in skull morphology requires a thorough comparative set of morphometric data. However historical variability in measurement techniques often precludes the reliable integration of multiple data sources. I propose a comparison of different methodologies and identify the potential for consistencies that will enable data sharing across these boundaries. I transcribed W.G. Haag's (1949) data sets and generated additional data from canid specimens curated in the comparative zooarchaeology collection at Binghamton University using a Next Engine 3D scanner. Using these sources of information, a comparative data set was established and test specimens of known origin were used to determine whether they are morphometrically associated with the correct phenotype groups. I perform a detrended correspondence analysis (DCA) to test whether population affinity may be determined from dog skulls just as it is from human skulls, given that dogs can be used as an archaeological proxy for humanity when studying certain aspects of prehistory. My discussion on the potential for reusability of these data sets demonstrates the need for cooperation in refining this type of osteometric approach. Additionally, these findings elucidate the potential for 3D technology in further zooarchaeological studies.

Keywords: *Morphometrics, 3D scanning, population affinity, dogs, Canis familiaris*

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The arrival of domestic cats to the UK and Ireland: An ancient DNA study

Cats are the second most popular pets in the UK after dogs. Despite our love of cats we don't know much about how domestic cats arrived in Britain or Ireland. Or their relationship to the native European wildcat which is now only found in Scotland. Domestic cats spread across Europe starting in the Neolithic, with an increase in intensity around the Roman period and then again in the Medieval period with an increase in maritime transport. The study of both modern and ancient DNA has made it possible to see these movements. Recent research has made a start on furthering our understanding of cats although there are still large gaps. So far, the UK and Ireland have not had any ancient cat DNA analysed. This study will focus upon filling in this gap. My study will build on this work looking at trying to understand domestic cats arrived in the UK and Ireland.

Keywords: *Felis silvestris; Felis catus; biogeography, anthropogenic dispersal*

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Reviewing the rat: *Rattus rattus* and the archaeology of trade, urbanism, and disease in historic Europe

The black rat (*Rattus rattus*) is an iconic invasive species, food pest, and disease vector, often held up as the anthrodependent commensal animal par excellence. Having spread around much of the globe thanks to colonisation of anthropogenic niches, its presence can serve as a proxy for human settlement form, trade, and migration, as well as being relevant to the spread of past disease. While the significance of archaeological rat finds for European historical narratives has been recognised in a number of past studies, particularly in the 1990s, these have largely focused on western Europe and are due an update in light of recent data.

This paper reviews current evidence for the black rat's distribution in Antique and medieval Europe, with a focus on its potential importance for three major historical debates. Firstly, we consider the implications of apparent late Antique/early medieval range contraction for the timing and extent of post-Roman economic breakdown—a debate that can be traced back at least to Henri Pirenne's 1925 landmark *Medieval Cities*, and that remains active today. Secondly, we explore the (re)colonisation of northern Europe by rats in the context of developing northern Emporia network of trading settlements and the onset of the Viking Age. Finally, we turn to the classic question of rats' potential role as plague vectors during the first (Justinianic) and second (Black Death) pandemics.

Data are assembled from across Europe—including new results from under-studied regions, supported by ZooMS and radiocarbon dates—and assessed with the aid of probabilistic chronological modelling.

Keywords: *Black rat, Roman, medieval, anthropogenic dispersal, plague*

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Micromammals, humans and environments – long-term perspectives on human-micromammal relationships on Orkney, Scotland: Preliminary interpretations

Micromammals (rodents, shrews etc.) are a vital part of the ecosystem, being both numerous and highly adaptable species. Changes in taxonomic composition, population dynamics and taphonomy may not only reflect climatic changes but also suggest human-related impact, such as introductions or pest control. This is particularly evident in case of insular environments, with heavily restricted or lack of contacts with continental ecosystems and a simpler taxonomic composition of terrestrial species.

However, studies on long-term micromammal population dynamics utilizing a broad of methods are still a rarity.

This project seeks to track long-term changes in human-animal-environment interactions within in a geographically constrained and well-understood context. It will do this through studying micromammal remains retrieved from a broad selection of archaeological sites from Orkney archipelago. Pilot data from one key site, Skara Brae (Romaniuk et al. 2016), revealed that properly retrieved and studied assemblages can provide valuable information about human roles in creating micromammal assemblages. During this project a wide array of methods will be applied, including traditional zooarchaeology, scanning electron microscopy, collagen peptide fingerprinting, and stable isotope analysis. Here we present preliminary results of the project.

Romaniuk AA, Shepherd AN, Clarke DV, Sheridan AJ, Fraser S, Bartosiewicz L, Herman JS. 2016 Rodents: food or pests in Neolithic Orkney. R. Soc. open sci.3: 160514. http://dx.doi.org/10.1098/rsos.160514

Keywords: *Microfauna, isotopes, ZooMS, SEM, islands*

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Session title:

Animal remains and built space – contribution to the taphonomy of buildings

Session abstract:

The study of architectural remains like simple huts or more elaborate units such as urban dwellings, castles or religious contexts, represents a major topic in archaeological research. From an archaeozoological perspective, buildings often provide favourable taphonomic conditions for the preservation of biological remains – both through physical and chemical properties. Especially in hollow features like cellars or substructions, important assemblages of animal bones may accumulate.

Pathways by which animal remains enter built environments are manifold. Obviously, these can be related to the primary function of buildings and to the activities of former inhabitants. This notion is frequently encountered in studies of household activities and of spatial (horizontal) variation in general. Then it may correspond with the excavators' expectations in archaeological science, namely to contribute or to confirm the interpretation of building function. However, at least as animal remains are concerned assemblages from buildings apparently are often linked to processes other than primary use. They may have been brought in by soil movements during earthworks and foundation works, in the course of reconstructions, or as waste disposed after the abandonment. Although it seems counter-intuitive, these "secondary" or "unintentional" fills often largely prevail.

This session encourages papers, which discuss composition and formation processes of animal bone assemblages in relation to the life-cycle of buildings, to the internal stratigraphy and to the results provided by building research and other groups of archaeological finds. Especially welcome are experiences of animal remains contributing to, or being at odds with, suggested interpretations of built spaces.

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ORAL PRESENTATIONS

Inside Göbekli Tepe – dissecting a layer cake

Excavated since the mid-1990ies, Göbekli Tepe is now widely known for its famous megalithic architecture and amazing imagery. While the site's visible architecture has been recorded in some detail and in parts published, the stratigraphy inside and outside the megalithic buildings still awaits detailed analysis. While the relative chronology of the buildings and structures is quite complex due to rebuilding and recycling of building materials, the different agents and processes participating in the back-filling of the enclosures are even more difficult to unravel. In a common effort, an interdisciplinary team (archaeozoology, archaeology, architecture, physical geography) has set out to disentangle the taphonomic history of one of the main architectural features termed enclosure D. The microfauna identified in the sieved material is of particular importance for tracing Göbekli Tepe's taphonomic history. Here we present the first results of our analyses with a particular focus on the faunal remains.

Keywords: *Southeastern Anatolia, Göbekli Tepe, PPN, microfauna, taphonomic history*

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Butchery, consumption and disposal at Bronze Age Çukuriçi Höyük in Western Anatolia

Çukuriçi Höyük is a tell settlement in western Anatolia and one of the oldest sites on the western Mediterranean coast. It was settled starting at the beginning of the Pottery Neolithic and continued into Early Chalcolithic Period. After a hiatus, the settlement phases document human activities from the late Chalcolithic into the Early Bronze Age 1 dating to 2,900 – 2,750 calBC.

This paper is concerned with phase III, the last of the Early Bronze Age phases, and discusses how the recovered faunal remains have contributed to the understanding of the site and specific rooms and spaces within it. Of particular focus is how the study of the relative proportions of taxa, element representation, and recorded taphonomic modifications on the bones can help us understand how animal remains move around the site and how different taxa and elements come to be deposed of.

This paper will also discuss the methods of investigation that can be utilized for this small-scale, household-based study, when the dataset was not originally set up for this level of investigation. Whilst ideally the recording methodology would be originally set-up with this scale of study in mind before commencing, this paper will demonstrate that convincing results can be achieved even when this is not the case.

Keywords: *Western Anatolia, Early Bronze Age, coastal settlement, social taphonomy*

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Pottery and bones, foundations for good relations

At the multiperiod settlement hill of Oymaağaç Höyük (Samsun province, Turkey), the remains of two successive Bronze-Age monumental buildings were investigated between 2007 and 2017. Details of lay-out and masonry, together with associated finds, point at their interpretation as Hittite temples. The older building, erected in the 17th/16th c. BP, burned down around the turn of the 15th/14th c. BP. After a hiatus of 150 years, the new temple was constructed in the middle of the 13th c. BP, on top of the older building, making use of structures of its predecessor. It, too, fell victim to a conflagration event early in the 12th c. BP.

Episodes of building, destruction, re-building and use activities could be identified. These are reflected by pottery and faunal assemblages, albeit in variable amounts. Several contexts from both buildings represent unequivocal ritual deposits, characterized by specific material culture and structured bone assemblages. The largest sediment accumulations, however, were generated during foundation works, which cut up to 4m deep into older strata. The fills, designed to stabilize the walls, contained time-averaged pottery assemblages with many reworked sherds, while its faunal remains appear as rather homogenous, resulting from a single source – with less difference to the „cultic“ contexts, especially regarding species composition. Samples from destruction and walking horizons and outer areas were more deviant in both categories, but produced far less material. The relationships of pottery and bone within the same assemblage, along with other features, may thus provide a further tool for assessing taphonomic environments.

Keywords: *Northern Anatolia, Hittite Empire, Nerik, temple, contextual taphonomy*

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To believe or not to believe? The reliability of the animal remains as whisperers of the social stratification in the Bronze Age Monkodonja (Istria, Croatia)

Monkodonja, an Early and Middle Bronze Age hillfort settlement is one of the largest and most representative Istrian hillforts of the so called »Castellieri culture«. As such it has been the subject of systematic archaeological excavations for over a decade. It is located in a typical Karst region and placed on the top of the hill, from which a part of the maritime route along the eastern Adriatic coast could be controlled. This fact had to be important also for its establishing and prosperity.

The settlement consists of several clearly distinct areas (the “acropolis”, the upper town, the lower town) that are enclosed and thus separated by broad stone walls. Remains of more than 30 buildings has been excavated ranging from dwelling houses, storages, workshops to water accumulations, cult areas and possibly buildings for communal activities. The presented tripartite division of the settlement is supposed to mirror the social relations within the society, most probably a hierarchical social structure of the community. This thesis is here tested through the analysis of animal bones (>50,000), of which >30.000 originate from within the individual buildings. Great focus is given to the spatial distribution of the studied evidence, considering its association to individual buildings and other features as possible (!) indicators of social stratification and functional differentiation of the population.

Keywords: *Bronze Age, Istria, Monkodonja, social stratification, functional differentiation*

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Architecture and consumption in the Terrace House 2 in Ephesos

The terrace house 2 in Ephesos is located at the northern slope of the Bülbüldağ and consists of seven peristyle houses that were erected on artificial terraces. The entrances of the terrace house 2 are oriented towards steep uphill stair streets east and west of the complex. The architectonical arrangements within the houses define open social- and private spaces including kitchen and storage rooms.

The application of precise excavation methods brought amongst other Roman finds archaeozoological remains to light. The taphonomical history as well as the archaeological findings allows quite exact dating and interpretation of specific areas inside the houses. After a disastrous earth quake massive debris deposits were used as leveling layers, which sealed the original inventories inside some rooms. Therefore, food habits of the inhabitants might be reconstructed by these organic waste disposals.

More than this the multifaceted relationship of archaeozoological assemblages and architectonic features in the peristyle houses will be discussed. Some of the peristyle houses had smaller or larger basins supplied with running fresh water. Such places may be interpreted as intentionally formed recreational spaces. On the other hand such installations probably symbolize a fashionable peristyle garden including a fish pond in the Roman Period.

Keywords: *Ephesos, Terrace house 2, Roman Period, food, architecture*

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POSTER PRESENTATION

Meat consumption and discard in the context of economic formation processes at the Roman site of Carnuntum, Austria

Animal bones are an important part of the archaeological material and serve as indicators for the quality of human-animal-relations, dietary patterns as well as for economic trends. The analysis of handling with animal bones matters for the interpretation of zooarchaeological remains.

Therefore, the aim of the current study is the first-time analysis of selected zooarchaeological finds of the almost completely excavated so-called House 2 in the Roman town of Carnuntum (Austria). Attention is paid to the various butchery practices and the handling with animal bones in the context of economic production processes as well as to the discard behaviour.

The common species of this type of urban zooarchaeological assemblage are cattle, sheep/goat, pig, horse and dog. The consumption of the animal remains is evident for a great number of individuals based on the presence of chop and cut marks on the skeletal elements. Following an interdisciplinary approach and integrating GIS-based spatial analysis with zooarchaeological studies reveal the practice of various techniques used for meat exploitation and deposition of animal bones in Roman times as well as different reuse and recycling processes related to this type of archaeological finds, which can be dated from 1st cent. BC to 4th cent. AD according to the archaeological record.

Keywords: *Austria, Carnuntum, Roman Period, urban zooarchaeology, economic formation processes*

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Session title:

Teaching and outreach in zooarchaeology

Session abstract:

Becoming a zooarchaeologist requires receiving training from experienced zooarchaeologists. Most of us teach hands-on courses on zooarchaeology, whether they are about quantification, comparative osteomorphology, or preparing samples for isotopic analyses, as well as theoretical courses on reconstructing social, ecological, economic, cultural-historic and evolutionary aspects of past human-animal relationships. Further highlights of our curricula may include ethical aspects of our science such as data sharing. Additionally, an increasingly important aspect of our practice is to communicate zooarchaeology with the wider society, which has resulted in creative responses from zooarchaeologists and mutual benefits. How do we teach future zooarchaeologists? How do we overcome the challenges we face when we teach zooarchaeology, for example when we lack good comparative collections? Zooarchaeology is changing rapidly –how are we preparing future zooarchaeologists to build the future of zooarchaeology with mutual benefits for the wider public and our community? What are the inventive tools which we explore to explain our methods, practice, and high school kids, policy makers, prospective zooarchaeologists, to explain what zooarchaeology is? How do we disseminate our message? This session is intended as a platform to share our experiences in teaching and outreach activities, where we hope to combine classic oral presentations with a round table discussion, and given there is interest, document sharing.

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ORAL PRESENTATIONS

A pint of science, please! Talking of animal bones and teeth in pubs

Outreach events represent an invaluable source of communication among academic researchers and between these and the wider public. With this presentation, we intend to share the experience of the zooarchaeology team of the Department of Archaeology in Sheffield (UK) at the Pint of Science International Festival (Sheffield, 15th May 2018). This event was established in 2012 by UK-based researchers, and with time it grew into a global festival. The main aim of such event is to bring together scientists from different disciplines, who present to the public their research within the informal environment of a pub. In order to fill the gap between scientific research and the public, different strategies of communication are needed, affecting both discussion topics and delivery. In the occasion of this year's Pint of Science event, we decided to discuss about food taboos. In detail, we talked about the potential of animal remains in detecting the presence of different socio-cultural and religious groups. Indeed, food represents a vital biological need, but is also culturally determined, and such cultural variables can leave traces in faunal assemblages; this holds particularly true for communities characterised by the presence of permanent food taboos.

The main message emerging from our experience is that the selection of topics and activities in outreach events needs to be guided by some basic principles of social interaction and learning, though excessive simplification can be counterproductive in several ways. Topics closely related to current social and political issues should be preferentially targeted where possible.

Keywords: *Outreach events, zooarchaeology, Pint of Science, dietary taboos*

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Outreach at the margins of science and humanities: A tweet tweet tweet experience

Digital technology has lowered the cost of academic outreach projects. Since the 1990s blogs and informal internet publications have both flourished and failed. The last decade has seen the rise of different online platforms that provide a readily sharable medium for zooarchaeological outreach. The concise nature of new social media limits academic wordiness and jargon. The visual nature of these new platforms is more attractive and effective at communicating our research.

This paper examines the sufferings and successes of a fresh approach to digital outreach: #ClassicalZooarchaeology. After studying the online tactics of influential academics in zooarchaeology and related fields, I set out to use Twitter as my primary outreach tool. Here, I assess what works, what doesn't, and various approaches to better engagement with an interested public. As I've found, successful techniques are more about approach and not limited to one platform.

Outreach is a valuable tool that zooarchaeologists use to communicate their questions, methods, and results to both the general public and to colleagues in related disciplines. The informal engagement fostered by social media provides a more personal touch to online interaction and academic collaboration. Given the divide between different fields (different conferences, departments, and journals), I've found that social media is an important venue to bring together fellow practitioners from a wide variety of disciplines.

Keywords: *Zooarchaeology, classics, outreach, twitter, #scicomm, social media*

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STEM engagement, primary education and zooarchaeology in the UK

This paper will introduce research being undertaken as part of a PhD project on the use of archaeology to enhance Science, Technology, Engineering & Mathematics (STEM) participation in primary schools in the UK. The project is currently in its pilot stage and this talk will outline its rationale, some of its preliminary actions and findings and how these are guiding its future direction.

The impetus for this project came from the concern that the UK workforce is not equipped to meet growing demands from STEM industries. Recommendations for improving STEM participation in the UK highlight the importance of primary education (Council for Science and Technology, Royal Academy of Engineering, STEM Ambassador Scheme), and so this is where the research is focused. Although the project is primarily concerned with the UK education system, the methods and findings have the potential to be far more broadly applicable for education practitioners around the globe.

Keywords: *STEM, Primary education, engagement, zooarchaeological workshops*
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Digital media in support of teaching and outreach in zooarchaeology: 3-D imaging in the classroom

Becoming a zooarchaeologist invariably requires hands-on training in skeletal anatomy. From this fundamental basis, learning then develops to include one or more of the following: traditional techniques of analysis such quantification, comparative osteomorphology, aging and sexing; how to prepare the samples for molecular assessment; or theoretical courses on reconstructing social, ecological, economic, cultural-historic and evolutionary aspects of past human-animal relationships. Further highlights of our curricula may include ethical aspects of our science, such as data sharing. More recently, an increasingly important aspect of our practice has been to describe and communicate how our relationships with animals has changed over time with the wider society, a mutually beneficial endeavor that has resulted in creative responses from zooarchaeologists.

But how do we teach zooarchaeology with an increasing finite and hard-to-renew resource: animal bone? We face an ever-greater challenge to teaching zooarchaeology in that good comparative collections are hard to produce and maintain. Furthermore, how can we continue to build and reinforce engagement with the wider public and our local communities through outreach? This presentation briefly presents our experiences in teaching and outreach activities using 3-D digital scans, created in response to a lack of an sufficient osteological teaching collection. While digitalized models of bones cannot replace contact with real osteological material, they can serve as an aid to teaching and outreach.

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Teaching zooarchaeology: Bottom-up or top-down?

This talk will consider the content and the delivery of basic training in zooarchaeology, from the perspective of one who has tried to teach the subject for over 30 years. What might be ideal in theory, what works in practice, and what does not work?

Zooarchaeology can be taught from the bottom up (starting with basic practical methods and working up to thematic research questions) or top down (beginning with the questions and working towards the required practical methods). The former has greater ‘student appeal’; the latter better fits a scientific approach. The value of illustrative material (print, on-line images) in developing identification skills is questionable, as it excludes the important tactile information and haptic memory. I propose that comparative skeletal anatomy should be taught across a wide range of species so that students can work out an identification from first principles, not from ‘recognition’ of a limited, familiar set of

species. Having developed skills in identification and recording, the challenge is to take students through the middle stage of data exploration that links the bones to the big research questions, and to overcome the fear of quantitative data.

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Training archaeologists in 21st century Spain: The role of zooarchaeology in higher education

During the last two decades, Spanish system of higher education has undergone remarkable changes, as a result of combining an economic crisis with some controversial European policies. Theoretically, these policies had two main aims: making European higher education homologous, and making students more employable. This process, which has occurred also in most European countries, has been fiercely criticized by many for having led to an increasing marketisation of higher education. In Spain, the creation of shorter and more interdisciplinary degrees, has effectively meant that some disciplines have practically disappeared from teaching curricula. This has affected Archaeology in general -in many universities, Archaeology is offered only within the degree in History. The actual situation of archaeological subdisciplines, such as zooarchaeology, is somewhat unclear, but a preliminary evaluation (Grau 2012), already suggested quite a precarious and disparate situation.

Aiming to assess the current role of Zooarchaeology within undergraduate and postgraduate teaching in Spanish universities, Spanish academic zooarchaeologists have been given a questionnaire about their teaching and involvement in outreach activities. Their answers will be presented in this paper, providing an excellent topic of discussion for the session: are we doing enough for Zooarchaeology to occupy the place it deserves in the training of future archaeologists?

Reference:

Grau-Sologestoa, I. 2012. ¿El zooarqueólogo, una especie en vías de extinción? Los estudios de fauna en la universidad y en las empresas de Arqueología. Actas IV JIA 2011. Universidade do Algarve, 299-304.

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Actions teach louder than words: A multi-faceted approach to zooarchaeology teaching at Sheffield

Teaching zooarchaeology involves the combination of two main elements, the theoretical and the practical. This rather obvious dual approach, however, does not in itself guarantee a conducive and engaging environment to learning zooarchaeology. In this paper we discuss specific teaching approaches and tools that, at Sheffield, we employ to enhance the learning experience for zooarchaeology students. Much emphasis is placed on the hands-on experience. Beyond formalised practical exercises in the lab, students have unfettered access to a large volume of archaeological material and comparative collections and they are actively encouraged to use both. In this process, besides us, our team of doctoral students and post-docs take turns in mentoring less experienced students. Moreover, all members of our team participate in teaching with multiple benefits to all. The use of archaeological and comparative materials, however, is not enough and this is why we are constantly improving and creating new teaching tools, such as specific indices (e.g. fish, bird, skull, teeth, etc.). To engage our students further we constantly provide volunteering opportunities, which enhance learning and help build mutually beneficial relationships within the lab. There are further opportunities for extra-curricular learning and professional development that we regularly organise, such as our monthly ZooArchaeology in Progress (ZAP) meetings and seminars, weekly lab meetings open to all, and regular social events. We interpret the teaching of zooarchaeology as a holistic activity to be experienced inside and outside the classroom.

Keywords: *Zooarchaeology, teaching, holistic approach, learning tools, faunal collections*
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Rethinking how we teach zooarchaeology and building a teaching collection for faunal analysis

When I first taught zooarchaeology at New York University in the 1990s, I taught a graduate seminar that was taken by PhD students, and the focus of the course was primarily theoretical. Our comparative collection was limited, and those few archaeologists who were interested in zooarchaeology entered our program with substantial practical training. In the early 2000s, NYU developed an MA program in human skeletal biology. Zooarchaeology is an elective option for the skeletal biology program, and we also opened the faunal analysis course to our advanced honors undergraduates. This presentation will discuss how we developed a practical course in zooarchaeology that met the needs of our Honors BA and MA students and how we built a comparative collection designed for teaching purposes.

Keywords: *Teaching, forensic anthropology, comparative collections, zooarchaeology*
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Let's get digital: Teaching and sharing zooarchaeological methods using virtual and augmented reality

The basic method of looking at an archaeological bone, comparing it with recent (modern) skeletons, and then assigning it to a species (or some higher taxon) might seem fairly straightforward, but it actually requires a lot of knowledge, skill, experience, and above all, an extensive "reference collection" both at the training phase and in practice. Good reference collections, however, are not accessible to all, which is out of line with interests in democratizing higher education and science. Groningen Institute of Archaeology (=GIA) researchers and students have developed an Augmented Reality tool to enchance the accessibility of the GIA reference collections for teaching, outreach and research purposes. In this presentation we explain the current results of two experiments; 1. BONIFY v. 1.0, which has ported physical bones and teeth of sheep and goats in the GIA collection to Augmented Reality enabled devices via Structured Light Scanning (SLS), and 2. Hidden Hybrids, which aims to visualize and describe the osteomorphology of Bactrian, Dromedary, and their hybrids using different types of 3D scanning and Virtual Reality. Spoiler: We produce the images, place them in PC and mobile apps, and test their accuracy and user friendliness by asking students and researchers at various levels to try them out. Spoiler: We get mixed results.

Keywords: *Teaching tools, osteomorphology, augmented reality, sheep/goat, camels*
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Is this the future? Using 3D models to teach zooarchaeology virtually

Most of us are familiar with the uncertain feeling when faced with identifying bone in the absence of a physical comparative collection. In response to this challenge, numerous photographic atlases have been produced to provide 'access' to collections while in the field. Unfortunately, 2D images are constrained by their inability to be 'handled' and measured in the same way as a physical specimen.

The UNE Archaeology virtual bone database was developed as a pedagogical tool to teach off-campus students faunal analysis in an online environment. Accessible 3D models of human and animal bone were created that could be virtually 'handled' and measured. Given our field is predicated first and foremost on physical specimen ID – we received quite a few sceptical looks (and comments) on this approach. In this talk, I present our virtual bone project – and address the burning question – 'does it work?' I discuss its ability to facilitate robust identification of osteoarchaeological remains through the results of student assessments. I then compare the ability of students trained the traditional, hands-on way to those trained in the virtual classroom, in their ability to accurately identify material from an archaeological faunal assemblage via a two-week, advanced zooarchaeology field school in Cyprus, in which students from both walks of learning went head to head testing their identification skills.To see this work in action, please go to:https://www.youtube.com/watch?v=Rb39FOhdFts

Melanie Fillios, The University of New England, Australia

General Session:

Africa

ORAL PRESENTATIONS

New analysis of seal remains from Nelson Bay Cave, South Africa

Seals were a major item of diet for coastal hunter-gatherers and herders in South Africa. At Nelson Bay Cave, more than half of the Holocene mammal bones are from Cape Fur seals (Arctocephalus pusillus). Based on stable isotope analyses, Sealy (2006) has suggested that populations at Robberg specialised in high trophic level marine foods, including seals. Previous analyses of the seal assemblage from this site have studied only selected skeletal elements. Here, I present the first comprehensive analysis of seal remains from selected archaeological levels at Nelson Bay Cave and from the 2007/2008 excavations at Hoffmans/Robberg Cave. Body part representation, breakage patterns and cut and gnaw marks have been documented using the GIS based approach to faunal analysis refined by Marean et al. (2001), with observations digitally captured using the GIS based program ArcMap10.2. Preliminary results indicate that both adult and juvenile seals from one or more nearby seal colonies were exploited throughout the Holocene, in addition to probable scavenging of wash-ups. After 3500 BP there appears to be a greater preference for juvenile seals. Skeletal representation suggests that juvenile seals were butchered at the cave site while bigger, older individuals were field butchered. Large numbers of carpals, tarsals and metapodials, some with cut marks and lithic fragments embedded, reflect the importance of the flippers in the subsistence economy of hunter-gatherers. This pattern is consistent with ethnographic accounts of seal utilization elsewhere in the world, although there is no relevant ethnography from southern Africa.

Keywords: *Cape Fur Seals, Holocene, GIS*

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Animal resources exploitation in northern South Africa during the Middle Iron Age

This research presents an interpretation of the faunal remains from the 12th and 13th century AD site of Mapungubwe and Mutamba, both located in northern South Africa. Mapungubwe was regional capital while Mutamba is a small hinterland settlement on the the southernmost limit of Mapungubwe influence. The archaeozoological analysis of Mapungubwe includes the review of the faunal materials studied during the 1980s and in addition the animal bones from other squares that have never been studied until now. In previous studies, the attention was mainly focused on the sites in the Shashe-Limpopo River Confluence area. The reanalysis of previously studied fauna through the application of new methodologies and as well as new material from the hinterland from Mapungubwe through a regional approach are important aspects in the broader impact of the development of social complexity. Both domestic and wild animals had variable importance at both sites. This data is compared with published faunal materials from the larger region in order to understand the impact of animal exploitation in the development of social complexity in southern Africa. The archaeozoological studies of the materials from several archaeological sites during the Mapungubwe polity can shed some light on the social and economic choices that lead to the development of social complexity in the Limpopo Valley during the Middle Iron Age. In addition to providing knowledge about the farming system and the diet, faunal remains reflect the role of certain groups in the communities, as well as trade, social and ritual aspects will be discussed in this paper.

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Cattle and social formation in southern Africa during the second millennium AD

Early reports by travelers as well as historical, anthropological and ethnographic research of Bantu-speaking farmers from southern Africa during the last few centuries established that cattle had major economic, social and political significance. Zooarchaeological evidence supports the notion that cattle were of great importance to farmers, since fauna from the second millennium AD, called the Late Iron Age is dominated by cattle. One of the earliest examples from the Late Iron Age is Great Zimbabwe. Cattle were used to signal prestige, and were used for feasting, bride wealth payments, trade and tribute. The role of cattle in social formation increased the possibility of warfare and raids amongst farmers. While men, cattle and social formation are often equated, women also owned and controlled cattle herds.

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Cursed cows have short horns: How the Chinese proverb applies to ancient Egyptian cattle

Short-horned cattle is one of the reasons why one asks whether ancient Egyptians selectively bred animals. Evidence suggests that their attitude towards cattle was one of great complexity. For an Egyptian, the mutually exclusive approaches and understanding of the same phenomenon, did not seem to be inconsistent. Therefore cattle was “worshipped”, and slaughtered; symbolic to the king, and subdued; looked after, and tortured; lent an ear, and exploited; mummified and chopped. Cow’s form was given to deities and the netherworld creatures. Egyptians observed cattle, its appearance and behavior, which resulted in intriguing depictions, such as those in the Temple of Hatshepsut, where I am lucky to work, but also in perpetuation in language, script and broader associations. All this sheds some light on the primary Egyptian treatment of the animal in question.

It is beyond doubt that both domestic and wild cattle played fundamental role in economy of ancient Egypt, which is expressed i.a. in some annual or biennial event related to domestic cattle, and the whole country alike. Not without importance is the cattle mobility, not necessarily related to human migration in this particular case, however clearly related to a prominent event of the state and to queen Hatshepsut.

Bones, iconography, texts… Ancient Egyptian sources give a number of evidence for the cattle-human interaction, however paradoxically, it still seems to be little understood.

Keywords: *Cattle, ancient Egypt, Hatshepsut, mummies, iconography*

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POSTER PRESENTATION

Late Pleistocene range of Bos opisthonomus in the North-Eastern Africa and its significance within the subsistence model of Palaeolithic societies: New archaeozoological data from Affad, Sudan

The oldest known remains of African Aurochs came from Algeria and were dated to the middle Pleistocene. The range of occurrence of the Pleistocene aurochs have been defined basing on a dozen of finds from Algeria, Libia and Egyptian part of the Nile Valley. The sole locations in Sudan producing evidence of bos primigenious are dated to 11-9 millenium BP (Wadi El-Arab and Kashm el-Girba). During 2017 works in Affad Basin, c. 150 km down the Nile from the 4th cataract, numerous collections of mineralized bones of aurochs were discovered. The finds referred to the terminal Pleistocene (16 millenium BP) hunting sites. The poster presents this new discromanovery, its context and significance for the behaviour of ancient species estimating.

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General Session:

Genetics

ORAL PRESENTATIONS

Ancient mtDNA analyses of sheep domestication process on the way from its domestication center in Southeast Anatolia to West Anatolia

The start of the Neolithic age is considered as the beginning of modern civilization. The imprints of the early Neolithic age are largely embedded within the lands of Anatolia. At the start of the Neolithic age, sheep, cattle and goats were domesticated within the area spanning Central Anatolia and Northern Zagros Mountains. The area where the sheep was first domesticated, the sheep domestication center, is almost totally confined within Anatolia especially within Southeast Anatolia. Our study aims to contribute to the understanding of the sheep domestication process on the way from its domestication center to West Anatolia by using ancient mtDNA extracted from 234 sheep bone samples dating between Epipaleolithic and 2800 BCE from 9 archaeological excavations; Tepecik-Çiftlik, Yeşilova, Ulucak, Aktopraklık, Barcın, Çatalhöyük, Boncuklu, Canhasan III, Pınarbaşı. A 144 base paire (bp) long fragment of sheep mtDNA was successfully amplified for 124 of these samples yielding a success rate of 53%. The aimed 144 bp long fragment was shown to be able to identify five mtDNA haplogroups (A-E) observed in modern sheep breeds. We will present results on changes in th temporal and spatial distribution of haplogroups as well as ancient sheep genetic diversity in terms of haplotype and nucleotide diversity.

Keywords: *mtDNA, sheep domestication, Western Anatolia*

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Preliminary results on mtDNA haplogroups of ancient goat samples from Oylum Höyük

Anatolia, due to its geographical position, harbors the historical traces of many organisms' interactions within their own species and between the individuals of other species as well as their interaction with the environment. In this study, ancient DNA sequences were obtained for a DNA fragment which is 110 base pairs (bp) to determine mtDNA haplogroups (HPG) for goat samples from Oylum Höyük (Kilis). The haplogroups of 12 samples were successfully determined, 9 of which were A HPG and 3 of which were F or G HPG. Ancient goat samples were clustered with HPG A and F/G goats from Iran and Turkey on Neighbour-joining tree bootstrapped with 1000 replicates. However, according to Naderi et al. (2008), wild goats with HPGs A, G and C, could be collectively domesticated in Eastern and Southeastern Anatolia. Our results does not support this argument since we did not observed HPG C among ancient goat from Oylum Höyük. Oylum Höyük goat that we have studied may have come from elsewhere (eg from Iran). However, we shoudl interpret these results caustiously since HPG C may appear when we study more samples. On the other hand, presence of HPG F (which is found only in Sicily) in the form of HPG F/G among Oylum goat may be a signature of human-animal migration via maritime route from Levant. These questions can be answered more precisely with more data from Anatolia. Continuity simulations between;1) Oylum Höyük (BC 1800-30) goat samples (n=12) and Southern France Baume (BC 5950-5350) goat samples (n=15), 2) Oylum Höyük (BC 1800-30) goat samples (n=12) and West Azerbaijan Göytepe (MÖ 6000-5500) goat samples (n=4), 3) Oylum Höyük (BC 1800-30) goat samples (n=12) and Turkey Van Yoncetepe (MÖ 1000) goat samples (n=7) and finally, 4) The two periods of Oylum Höyük samples that Oylum Höyük 1 (OY1: BC 1800-1600 / n=2) and Oylum Höyük 2 (OY2: BC 1200-30 / n=10) were conducted. We observed genetic continuity only between Oylum Höyük samples.

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Insights into goat domestication from ancient genomics

Current genetic data are equivocal as to whether goat domestication was a singular or multiple event - mtDNA diversity shows multiple haplogroups but these may be modelled to come from a single source. To investigate this, we generated genomic data from ancient goats from regions within and adjacent to the Near East. Our results are consistent with domestication modelled as a dispersed process. We also model how these early populations contributed to modern continental groups and investigate whether signals of selection for specific traits may be read within the Neolithic populations. The invaluable contributions of multiple collaborating investigators will be fully acknowledged within this talk.

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POSTER PRESENTATION

Did late Pleistocene humans introduce *Sus scrofa* into the Ryukyu Islands?: DNA analyses of ancient and modern samples

Ryukyu wild boar (Sus scrofa riukiuanus) is one of the subspecies of wild boar inhabits seven islands of the Ryukyu Islands, southern Japan. Although they are recognized as “wild” boar today, the origin of them is not clear yet. There are two hypotheses related to this question: first, wild boar naturally migrated from the Eurasian continent across the land bridge that appeared earlier than the late Pleistocene; second, human introduced wild boar to the Ryukyu Islands with their migration during the late Pleistocene, ca. 30 – 20 ka BP, at the time above-mentioned land bridge have already disappeared. If second hypothesis is correct, it is the world’s oldest case for an introduction of live Sus scrofa to the island environment by human. To investigate the adequacy of these two hypotheses, ancient DNA analysis of Sus samples from archaeological sites, and DNA analysis of modern Ryukyu wild boar samples were carried out in this study. By comparing genetic characteristics of archaeological and modern samples, 1) frequency of haplotype in each habitat, 2) divergence time of Ryukyu wild boar from other Sus lineages, 3) and possibility of gene flow from other Sus lineages to Ryukyu wild boar population were estimated. Based on these estimations, I discuss the genetic background of Sus scrofa in the Ryukyu Islands.

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General Session:

Fish

ORAL PRESENTATIONS

From sea to desert platter- the role of fish in the Byzantine Negev

During the Roman and Byzantine periods (1st–6th centuries A.D.), we find evidence for major expansion of agriculture in the Negev. Recent excavation of some of the major sites: Halutza, Shivta and Nitzana, included application of systematic sieving with fine mesh. Surprisingly, among the vertebrate remains fish were highly abundant. Here we present preliminary analyses of ca. 7000 fish remains recovered from garbage dumps and abandoned houses of Shivta (NISP=5,000) and Elusa (NISP=1380), dated to the Late Byzantine and Early Islamic periods. The preponderance of fish remains exhibits, for the first time that fish played a major role in the diet of the sites inhabitants, as well as in the economy and trade relations with neighboring areas. We find evidence that the fish originated from diverse and separated aquatic habitats including the Red Sea, Mediterranean Sea, Nile, and freshwater. All were exported through the Negev sites and were used for personal consumption or as trading goods. The information obtained from the fish remains, can significantly contribute to the debate regarding the impact of climate versus social and political shifts towards the end of the Byzantine period.

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Influence of marine habitats and fishing techniques on the fish eaten at coastal settlements in 18th century Qatar.

Several excavations of coastal settlements around Qatar, primarily dated to the 18th Century, have yielded substantial assemblages of faunal remains. These are dominated by fish and the marine environment was heavily depended upon to provide these settlements with food. Traditional fishing methods used a range of techniques and these would have been dictated by the topography and sediments comprising the marine habitats exploited. Much of the fish caught were local to each settlement and this is indicated by the composition of the faunal remains. At the sites of Zubarah and Freiha, on the north-western side of the peninsula, many parrotfish and angelfish were consumed reflecting the presence of coral reefs close enough to be visited regularly. An almost complete absence of these species at Fuwairit on the north-eastern side of the country correlates to the absence of reef habitats in adjacent waters. A moderate quantity of parrotfish at Doha, further south on the eastern coast, reflects the patchy distribution of coral reefs in the vicinity. The use of boats to target deeper waters and large pelagic fish also varied between the sites. This presentation will also discuss the difficulties in trying to interpret the prevalence of different fishing techniques that included basket traps, beach seines, intertidal fish traps, casting nets and hand-lines, when many species can be caught by a range of techniques.

Keywords: *Fish, Qatar, marine habitat, fishing techniques* Lisa

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Fishing in southern Vietnam: Strategies, technical knowledge and regional variability of osseous technology

The use of osseous materials for the production and use in fishing activities appears to hold some significance in prehistoric coastal communities of Sundaland. The sites of An Son, Gò Ô Chùa and Lò G?ch would have been located a short distance from the coast, on the Vàm C? Dông and Vàm C? Tây rivers during their occupation, when the sea level was somewhat higher than present. Fishing appears to be one of the main activities at these sites. The implements used in fishing activities can come in several forms; leisters, hooks, net weights, and harpoons. Many of these implements have been made from osseous materials due to the lack of high quality stone materials in the region. Undertaking chaîne opératoire approach and completing a functional and use-wear analysis of the osseous implements of these sites will identify those that were used for hunting and/or fishing activities. Based on the faunal analysis undertaken at these sites, determinations can be made regarding the representation of aquatic remains in the assemblage and potentially make links to the implements used in their capture. By reconstructing the chaîne opératoire, implications of the societal importance of osseous materials may become apparent. Furthermore, the varied forms of fishing equipment can reveal the inherent knowledge of the community in a multitude of hunting strategies, and manufacturing techniques. This can have further implications regarding the transfer of knowledge within, and between communities in southern Vietnam.

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POSTER PRESENTATIONS

Catches and bycatch of marine fauna can be used for reconstruction of marine economy

Composition of kitchen refuse of ancient sites is an important source of data on techniques and seasonality of fisheries which is important if there is lack of tools and records. Here we analyze marine fauna found in 2011-13 in a cistern in the Tauric Chersonesus from a short time range within 400-530 CE. Marine fish mostly consisted of the turbot and rays, with some anchovy, sand smelts, sprat, and a few sturgeons, carps and a zander. Among marine birds the most abundant were the Yelcouan Shearwater, the Cormorant (and some Shags), the Black-throated Diver, the Pochard and the Great Crested Grebe. Therefore, diving fish-eating, probably bycaught, birds dominated in the waterfowl. Marine mammals were: the harbour porpoise, the common dolphin and the bottlenose dolphin, the former two equally abundant. Dolphins were largely juveniles, whereas porpoises were of the full age range. Predominance of the turbot and rays is the best indicator for bottom-set gillnets focused on spring and summer. Anchovy is indicative for coastal set nets, possibly all year round, and sprat could only be taken by archaic purse seine nets. Marine birds could be bycaught in all these types of nets; interestingly, many of them are wintering species, thus, being an evidence for intensive winter fisheries. Harbour porpoises were bycaught in gillnets, whereas common dolphins could be only directly caught, possibly, by purse seine nets. Thus, the marine fauna assemblage is an evidence for diverse, all year round fishing practices including purse seine and winter operations.

Keywords: *Fish, birds, cetaceans, bycatch, gillnets, purse seine, Black Sea*

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Zooarchaeology of the Native American Sturgeon Fishery in Coastal Oregon, 350 BC to AD 1150

Sturgeon remains are relatively rare in the archaeological record due to their largely cartilaginous skeleton. What remains are the scutes, bony scale-like plates found on the outside of the body, and some diagnostic cranial features. Consequently, questions remain about both the prehistoric dietary importance of sturgeon and the species that were being exploited in western North America. The Par Tee site on the Oregon Coast produced a massive faunal collection, allowing for the comprehensive analysis of usually under-represented faunal categories. Two sturgeon species on the Northwest coast, the green (Acipenser medirostris) and the white (Acipenser transmontanus) are both of conservation concern. Here we present the results of our analysis of sturgeon remains from the Par Tee site, including abundance and element data and ancient DNA species identifications. These data provide the first species identifications for sturgeon from the Oregon Coast and enhance our understanding of the prehistoric fishery.

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General Session:

Methods

ORAL PRESENTATIONS

Using differential geometric methods and machine learning to improve zooarchaeological methods for classifying fragmented faunal remains

Meat eating, hunting and scavenging are central to understanding human evolution and behavior. Accurately identifying fragments and the agents that broke them is essential to site reconstruction and the detection of hominin activity. Determining how bones were fragmented is challenging given the variety of potential agents that could be responsible for damaging them. Surface marks have been more reliable than breakage patterns, but the criteria for distinguishing marks are subject to equifinality. Moreover, surface studies are not useful when surface preservation is poor. Breakage patterns are useful for differentiating fresh bone breaks from dry bone breaks, but studies have failed to provide robust methods for distinguishing agents of bone breakage. This failure could be that current methods do not capture a sufficient amount of shape information on the fragment. Here we present a method that uses surface curvature, other differential geometric invariants and machine learning on 3D digital models of experimentally derived bone fragments to classify fragments according to the agents that broke them. In our analyses, we describe the shape of the surface by using a much greater number of geometric characteristics than used by traditional zooarchaeological methods. Our geometrical and data analytical tools provide means to quickly and efficiently capture and exploit a rich amount of shape information that will provide a framework for developing useful protocols that can be applied to rigorously test competing hypotheses regarding human evolution and behavior surpassing the current state-of-the-art in zooarchaeology and taphonomy.

Keywords: *Bone breakage, carnivore, hominin, machine learning, surface curvature*

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Sharing and combining geometric morphometric datasets to track the long history of pig domestication in Southwest Asia

The long history of pig domestication has been the subject of growing attention especially in Southwest Asia where the first signs of pig domestication appeared about ~8.500 BC. An increasing number of studies are using morphometrics and especially geometric morphometrics to explore the differences between wild and domestic populations or to track temporal and/or geographic variation of the domestic pig stock. The temptation is now to bring together existing datasets into a more integrated approach. But because geometric morphometrics allows dissecting morphological variation with high accuracy, the slightest disruption in measurement can have significant effects on the results. For example, combining data obtained using distinct measurement devices and multiple operators can lead to a misinterpretation of the results. In a first instance we used 2D coordinates measured on modern wild and domestic pig teeth (second and third upper and lower molars) to perform a set of analyses comparing operator and inter-operator error, and the power of discrimination between the two

known groups. We then used archaeological specimens to confirm the inter-operability of the analyses before selecting the best approach to combine available datasets. The main aim of this study is to allow a combination of a maximum of datasets gathered on the Southwest Asian pig from the Mesolithic to nowadays, leading to a better understanding of the long-term relationships between human and pigs in Southwest Asia.

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Identifying and interpreting barrelled meat assemblages

As the world became increasingly globalised and food production increasingly centralised, people began to rely less on locally produced meat resources and more on imported, packed and preserved food products. Throughout much of the historical period (last 500 years), many imported foodstuffs came in the form of barrelled meat. While archaeologists working in this time period recognise there is a high potential that the faunal remains being recovered at their sites are sourced from elsewhere, they have struggled to find a way to confirm this without resorting to expensive and time-consuming biochemical analyses. Butchery marks and body portion representation have so far proven difficult to interpret. Historical documents and an increasing number of intact barrelled meat assemblages recovered from shipwrecks suggest there is high variability in the ways animals were butchered and packed into barrels. However, a recent case study looking at archaeological sites from 19th-century Ontario revealed differences in the presence of canine teeth between barrelled-pork production centres and residential assemblages. This is related to the packaging process and links are made to historic documentation, providing a possible way of identifying the presence of barrelled pork at archaeological sites. Further discussion builds on the attributes often associated with eating barrelled meat and explores how its unique features dramatically alter foodways and can shape local identities.

Keywords: *Barrelled meat, Historical/Post-Medieval zooarchaeology, foodways* Eric Tourigny, Newcastle University. eric.tourigny@ncl.ac.uk

POSTER PRESENTATIONS

EVOSHEEP – First zootechnical innovations in Southwest Asian societies (6th-1rst millennia B.C.): Origin and development of sheep breeds – An ANR Project

EVOSHEEP project is studying the origin and evolution of sheep breeds in societies of south-west Asia from the Late Neolithic, the Chalcolithic and the Bronze Age. EVOSHEEP associates complementary approaches focusing on the practices of pastoral societies: archaeozoology, philology, iconography and paleogenetics. It is based on the study of faunal bones from archaeological sites dating between the sixth and the first millennia B.C. in the South Caucasus (Armenia, Georgia, Azerbaijan), Anatolia, Iran, the Near East (Iraqi Kurdistan, Syria, Lebanon), and Eastern Africa (Egypt and Sudan). A study protocol for morphometric and genetic analyses of sheep bones is developed in order to provide new diagnostic characters for differentiating breeds. The same approach will be applied on present-day breeds of Asian and African sheep from our on-going sheep reference collections and Museum collections. Sheep breeds will also be analysed through the Sumero-Akkadian cuneiform documentation of the 3rd and 2nd millennia BC and the iconography of the Near East. The originality of EVOSHEEP is to combine morphometric and genetic data from ancient and modern breeds to document the pace of the emergence of sheep breed in the course of the growing complexity of Near and Middle Eastern societies. EVOSHEEP is financed by the French National Research Agency (ANR).

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Sheep birth distribution in past herds in European mountain by analysis of teeth enamel Oxygen isotope ratios

Within pastoral societies, the birth period is a crucial parameter in the organization of the activities. It also induces seasonal variation in fresh animal products availability, in particular milk. In temperate latitudes, sheep have a seasonal breeding round leading to births occurring later from winter to early summer. However, some current breeds have a longer duration of the period of births, providing a longer period of access to key animal resources throughout the year. A recent study of Balasse et al. highlighted that domestication led to an extension of the period of sexual activity in sheep. However, this phenomenon still needs to be explored in past sheep herds from mountain area where topography and climate may be constraining for the management of reproduction. The sequential analysis in tooth enamel (?18O) allows us to access to the information related to the season of birth of archaeological sheep. In this paper, birth distribution is investigated through the analysis of sheep teeth from Neolithic and Bronze Age settlements of La Soie (Valais, Switzerland) and Llo (Pyrenees Orientales, France). The results demonstrate a restricted period of birth but also out-of-season births during late Neolithic and Bronze Age period. Thus, in this marginal environment, husbandry strategies were efficient enough for the survival of lambs born out of season. Furthermore, breeders have been able to take profit of this trait. Could it be the first signs of a modification of the pastoral calendar in mountain areas?

Keywords: *Stable isotopes; pastoralism; saisonnality*

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The impact of mobility on the morphology of the astragalus in Suids raised in captivity

We conducted an ecomorphological study of three groups of Suids farmed in Quebec with the aim of identifying the impact of mobility on the development of the morphology of the astragalus (tarsus). Two groups of domestic pigs were studied, one group was raised in indoor pens and the other group had access to external pens. The third group consisted of boars raised with access to external pens. We used linear discriminant analysis to explore morphometric differences between all three groups of animals. Our results show that there are statistically significant differences in the morphology of the astragalus in Suids with different levels of mobility. The method we develop uses a small number of easily reproduced variables and could be used to reconstruct past husbandry practices and, given the potential link between mobility and the type of vegetation cover, holds considerable potential for paleoenvironmental reconstruction.

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Studying caprine breeds from protohistoric Provence and Southern Alps (France) : 3D geometric morphometrics applied to postcranial bones

Past sheep and goat husbandry can be analyzed using various approaches in zooarchaeology. However, with classical osteometric studies, some limitations are generally reached for describing more precisely the phenotypical patterns of the animal breeds. In order to better understand the evolution of pastoral economies in the Bronze and Iron Age Provence (southern France) which underwent a number of economic and socio-political changes at the regional and local scales such as the emergence of complex societies, the development of colonial settlements and later the impact of Romanization, our research focuses on the characterization of the small livestock diversity exploited during this period. For this purpose, we developed a 3D geometric morphometric (GMM) approach based on the analysis of two sheep and goat postcranial bones, the humerus and the astragalus. For this comparative study, a total sample of 50 modern and 150 archaeological specimens have been collected and recorded in 3D models. The GMM and statistical analyses were performed on landmarks and curves using '3DReshaper' and 'R' software. The results are finally compared with those obtained from osteometric studies based on standard and additional bone measurements to test and assess the degree of reliability and efficiency for discriminating different animal populations.

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Distinguishing the thoracic vertebrae of the Common Duiker (*Sylvicapra grimmia*) from other small Antelopes

Vertebrae are rarely found intact in archaeological assemblages and are often very fragmented. These specimens are usually included under the unidentifiable category. However, it has been found that the thoracic vertebrae could well be indicative of certain species. In most mammal species the anatomy of the thoracic vertebrae is relatively similar, with the exception of the presence of either a large caudal notch (incisura vertebralis caudalis) or a lateral foramen (foramen vertebrale laterale). The conversion of the caudal notch into a single lateral foramen is only found in certain Equidae and some Bovidae, as well as in Suiodea where the foramen is often doubled. Amongst the small bovids from southern Africa, the presence of a lateral foramen in the thoracic vertebrae is only distinctive in the common duiker (Sylvicapra grimmia). The lateral foramen also extends into the lumbar vertebrae of the common duiker. The thoracic and lumbar vertebrae of all the small Bovidae species were compared to

the vertebrae of 25 specimens of the common duiker from various ages, sex, and locations throughout southern Africa, and the presence of a vertebral lateral foramen was only present in the common duiker. In all the other small antelope species, only a caudal notch is present in both the thoracic and lumbar vertebrae. It is thus evident that fragments of thoracic and lumber vertebrae that are of a comparable size to a Bovid I size class, with a vertebral lateral foramen present, could only belong to a common duiker.

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Mapping the Truth: Implications of fossil orientation and distribution for the site formation history of Schöningen 13II-4

I would like my poster to be considered for the poster prizes. KEY WORDS Spatial analysis, Orientation analysis, Site formation processes, Middle Pleistocene The Lower Palaeolithic, Middle Pleistocene locality Schöningen has been a focus of archaeological research for over two decades. The locality is best-known for the discovery of wooden spears in close association with numerous butchered remains of horses and other large mammals in the Spear Horizon (Schö 13II-4), which has an age of ca. 300 kyr. Several site formation models have been proposed to explain the faunal accumulation at the site by Thieme (2005), Voormolen (2008), Lang and colleagues (2012) and Stahlschmidt and colleagues (2015). Visual spatial analyses allow for the incorporation of archaeological knowledge in the interpretation of spatial data, while spatial statistics allow for subjective and reproducible inferences about spatial patterns. The combination of the two could thus provide a vital tool in disentangling complex site formation processes. This study uses a combination of visual spatial analyses, spatial statistics and orientation analyses in order to further disentangle the site formation history of Schö 13II-4 and to assess the impact of post-depositional processes on the faunal assemblage. Preliminary results of the analyses revealed the existence of intra-site and inter-species differences in spatial distribution and orientation. The results of this study are compared to the suggested site formation models for Schö 13II-4 to test which of these models is most parsimonious with the spatial distribution and orientation of the faunal assemblage.

References:

Lang, J., J. Winsemann, S. Steinmetz, U. Polom, L. Pollok, U. Böhner, J. Serangeli, C. Brandes, A. Hampel and S. Winghart, 2012. The Pleistocene of Schöningen, Germany: a complex tunnel valley fill revealed from 3D subsurface modelling and shear wave seismics. Quaternary Science Reviews 39, 86-105.

Stahlschmidt, M.C., C.E. Miller, B. Ligouis, P. Goldberg, F. Berna, B. Urban and N.J. Conard, 2015. The depositional environments of Schöningen 13 II-4 and their archaeological implications. Journal of Human Evolution 89, 71-91.

Thieme, H., 2005. The Lower Palaeolithic art of hunting: the case of Schöningen 13II-4, Lower Saxony, Germany, in C. Gamble and M. Porr (eds.). The hominid individual in context: archaeological investigations of Lower and Middle Palaeolithic landscapes, locales and artefacts. London: Routledge, 115-132.

Voormolen, B., 2008. Ancient Hunters, Modern Butchers. Schöningen 13II-4, a kill-butchery site dating from the northwest European Lower Palaeolithic. Leiden (unpublished Ph.D. thesis, Leiden University).

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7TH SEPTEMBER
FRIDAY

Session title:

Animal introduction, adaptation and exploitation around the Baltic and beyond

Session abstract:

The Baltic Sea connects the shores of nine present-day countries – all having a long and colorful history. Connections within this region are known to have existed since the first human settlement, forming economic, cultural and natural processes. In zooarchaeology these complex processes are reflected in the introduction and exploitation of different animals.

Given the diversity in zooarchaeological research in the region, we invite scholars to consider similarities and differences in human-animal relationships around the Baltic. What role has the sea played in "connecting" and "separating" peoples? How has local climate affected the introduction of domestic species and exploitation of game? How has maritime trade influenced the long-distance circulation of animal products from the European mainland and even Asia? Osteological remains are our primary source in studying these questions. However, we encourage a broad multidisciplinary approach, integrating historical documents, iconography, ethnography as well as sophisticated laboratory analyses. A critical evaluation of parallels and expanding evidence by applying advanced techniques could answer concrete questions such as cold adaptation, the religious/ritual use of animals, and trends in Hanseatic trade.

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ORAL PRESENTATIONS

Radiocarbon dated fauna on the early settlements in Northern Sweden

In northern Europe as the Weichsel glacier ice sheet slowly receded Mesolithic pioneer settlers moved onto this newly appearing land. Yet prior to human occupation, novel vegetation and fauna communities had established themselves in this area. In this paper I will explore how archaeozoological remains on early settlements in northern Sweden can inform on human use of faunal resources. Thanks to the practice of bone burning at these settlements we can analyse faunal remains that would otherwise have decomposed in the acidic soil characteristic of these sites. Previous research at middle Mesolithic human settlement sites has allowed us to better understand the timing by which reindeer (*Rangifer tarandus*), elk (*Alces alces*) and ringed seal (*Phoca hispida*) came to be present in northern Sweden. Likewise, the results of ^{14}C dating of animal bones from the sites included in this study show not only the date of settlement habitation, but also provide more information on the timing with which different species came to occupy this landscape. This presentation further examines the range of species that humans brought to their settlements, how these resources were utilized, and what the faunal remains can reveal about different groups of people active on the landscape at this time.

Keywords: *Mesolithic, settlements, northern Sweden, radiocarbon dates, burnt bones*

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The food-economy of Northern Norway in the Younger Stone Age based on animal remains from archaeological sites in the Varangerfjord area

This paper aims to investigate the food-economy of the Younger Stone Age (5000–1600 BC) in the Varangerfjord area in Arctic northeastern Norway. Varangerfjord represents a unique area with a good number of archeological sites with well-preserved archaeological and environmental data which will contribute to a better understanding of subsistence strategies and everyday practices of prehistoric societies in the Arctic regions. The fundamental questions such as human diet, cooking and carcass processing methods, animal management, seasonality of exploitation, and site types are discussed. The emphasis is placed on the questions of how food-economy, settlement, society, and environmental change were interrelated through these three and a half thousand years with a particular focus on the transition from relatively small dwellings to the large so-called Gressbakken dwellings at around 2400 BC. This transition has often been interpreted to reflect economic intensification, higher degree of sedentism and complex and territorial communities that flourished thanks to an allegedly resource-rich environment. This paper investigates whether the new analyses of the animal remains support this interpretation. Preliminary analyses of new, recently excavated coastal sites from the early Younger Stone Age indicate seasonal occupation (spring/summer) with strong focus on locally available marine resources (Atlantic cod, harp and ringed seal) but with significant terrestrial input (reindeer), which is in accordance with previous understandings of such sites.

Keywords: *Norway, Arctic, Younger Stone Age, food-economy*

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Tiptoeing around the marrow pot: Marrow fracturing in Neolithic European elk in Northern Sweden

This is a study of marrow exploitation in European elk (*Alces alces*), a little known subject. The bone remains originate from Bellsås (Jämtland county), and Bastuloken (Västernorrland county) in northern Sweden. Both sites have been interpreted as Neolithic settlements, dated to between 5745–5190 BP and 4400–3800 BP respectively. The aim is to understand how the extraction and use of bone marrow varied between the two sites. Bones containing white marrow have been analysed: the mandibula, long bones, and the first and second phalanges. Frequencies and locations of point of impact have been recorded in search of possible patterns in marrow fracturing. Although post excavation factors prevented it from being employed to its full potential, a variant of Outram's fracture freshness index (FFI) was used as a part of the analysis.

The anatomical representation differs slightly between the two sites. The later site, Bastuloken has significantly more phalanges than earlier Bellsås. Phalanges at Bastuloken show a different breakage pattern with a possible connection to how they were split for marrow. This study has the potential to provide a deeper insight in to how the practise of utilizing bone marrow varies in intensity and technique in the region.

Keywords: *European elk, bone marrow, marrow extraction, phalanges*

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Tracking venison: Skeletal element weight distributions in large cervids in Scandinavia

Among large game, deer species have played an important role in meat provisioning throughout the history of Scandinavia. Depending on geographical location at least one of three large species, European elk (*Alces alces* L., 1758), red deer (*Cervus elaphus* L., 1758) and reindeer (*Rangifer tarandus* L., 1758; including the domestic form) can be represented by major assemblages, especially at prehistoric sites. The anatomical distribution of their skeletal parts has the potential of shedding light on various aspects of carcass handling and meat consumption. Since comparisons between these archaeological remains and the complete skeleton using the number of identifiable specimens (NISP) are heavily biased by fragmentation the use of bone weights is proposed. As an archaeological example, differences between the anatomical representation of reindeer are reviewed on the basis of the ratio between bone weights within complete present-day adult skeletons. A critical review of the weighing method is included with regard to differential preservation including fossil diagenesis as well as post-excavation handling.

Keywords: *Cervid bone, anatomical distribution, weighing method, Scandinavia*

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Of sea and of land: Diverse animal exploitation strategies used by Neolithic Pitted Ware groups along the southwestern Baltic coast

The Middle Neolithic Pitted Ware Complex (PWC) groups (3700–1700 cal BC) of eastern Central Sweden and associated archipelagos engaged almost exclusively in subsistence systems based on marine resources such as seals, coastal Baltic Sea fishes, as well as terrestrial prey, in particular deer. However, PWC groups located further to the south in Denmark, who were in close proximity to contemporaneous Funnel Beaker (TRB) and Single Grave communities, appear to have instead pursued different animal use strategies that involved the exploitation of aurochs or cattle, hunting of wild terrestrial prey, seal hunting, and fishing.

Using combined zooarchaeological and stable isotopic analyses, we investigate the precise nature of animal exploitation systems at the PWC sites of Kainsbakke and Kirial Bro (ca. 3200–2700 cal BC) located on the Baltic Coast of Djursland (Denmark) in order to better understand their subsistence connections and separations with their immediate agriculturalist neighbours and the marine-oriented communities located in the PWC heartland of Sweden. Our data indicate multi-resource animal use that maintains marine PWC traditions of sealing and fishing, but also incorporates animal exploitation strategies, in particular cattle husbandry, likely inspired by agricultural communities. We argue that this broad-spectrum exploitation strategy used by PWC groups in Djursland not only provided a resilient and reliable source of protein and fat throughout the year, but it also maintained cultural traditions shared with PWC groups located across the Kattegat in Sweden while the PWC people simultaneously developed new practices influenced by connections with TRB communities.

Keywords: *Marine-based subsistence, animal husbandry, body size, demography, stable isotope analysis*

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Dog associated bone groups in Liv cemeteries of the Late Iron Age in present-day Latvia

This study provides detailed overview of the dog associated bone groups (ABGs) found in the eastern region of the Baltic Sea corresponding to the areas inhabited in the Late Iron Age by Finno-Ugors – Livs. In the Late Iron Age this region was a border zone between Finno-Ugric, Slavic and Baltic tribes. ABGs of dogs have been found in cultural layers of settlements and hill-forts inhabited by Baltic tribes as well, but only in Finno-Ugric burials dog skeletons have been found associated with inhumations and cremation burials in both flat graves and barrows.

Forty-nine ABGs of dogs at 14 Liv burial grounds have been found as part of high status burials. The first author has also determined the sex of buried dogs which shows that there is no observed correlation between the gender of the buried owner and that of his or her dog. In cases of full skeleton preserved, analysis of the cervical vertebrae of the buried dogs was performed with an aim to identify injuries and traumas that could have been left by the sacrificial process. Osteometric measurements of dog bones, determination of the age of dogs by a degree of tooth wear and ^{14}C dating were carried out as well. Finally, paleodiet analysis of the Livs'dogs has been performed by measuring stable δ13C and δ15N isotope ratios. The results are plotted against human isotope data and a large animal isotope dataset. The animals sampled include dog, chicken, rabbit, cattle, horse, domesticated pig, beaver, brown bear and fish bones.

Keywords: *Dogs, Finno-Ugors, carbon and nitrogen stable isotopes, paleodiet, zooarchaeology*

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Cut marks on bones, traces of ritual through animal remains at Helgö, Sweden

On the island of Helgö in the lake of Mälaren in the central eastern part of Sweden, around 20 km west of central Stockholm, there is a multi-period settlement. This study is concentrated on a cult house which dates from around the migration period (400–550AD). It is filled with large quantities of both burned and unburned bones with a total weight of 13 406 grams, of which 4508 grams have been analysed. About 10 % of the analysed material is burned. With a few exceptions, all remains originate from domesticated animals commonly found in the area, cattle, caprines, pig and some horse represented by teeth. Other finds in the house, such as figure foils made out of gold and drinking cups made out of glass, serve to indicate its role as a place for rituals and festivities.

This paper takes a look into the patterns of cut marks present on nearly every type of animal bone. It will also investigate the thoroughly burned bones to determine their relationship to the unburned bones and the house itself. The large amount of animal remains and the closeness to a clearly marked sacrificial ground indicate the importance of the studied building with regards to rituals and festivities. Everyday life and activities at one of Sweden's most important cultic settlements will be better understood with the help of the animal remains found.

Keywords: *Scandinavia, ritual, Iron Age, burned bones, domesticated animals*

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Through a magnifying-glass, and what we found there about bird exploitation on a Baltic island during the Bronze Age (and a little beyond)

Saaremaa Island, Estonia, locating in the eastern part of the Baltic Sea, was inhabited by people since the Late Mesolithic. Asva, Kaali and Ridala are sites dated to the Late Bronze Age, at the time when Saaremaa people already applied agriculture but still exploited wild animals like seals, fish, and birds. Birds are represented by more than a thousand bones coming from more than 50 species and that were excavated at times from the 1930s up to 2014. This assemblage is largely dominated by waterfowl, mainly ducks, yet other birds were also identified (e.g., Charadriiformes, Accipitriformes). Taxonomical composition indicates that islanders hunted birds rather opportunistically, although they were surely quite capable waterfowl hunters. Interestingly, identified bird fauna contains species that no longer occupy the region as well as species that visit it only seasonally (during either summer or winter). The latter may suggest that the sites were occupied all year round. Excavated bones indicate that Saaremaa inhabitants have been rearing waterfowl as early as during the Bronze Age. Traces found on the bone surfaces confirm that birds were used for food. Other traces indicate that bird bones were casual (if not tiresomely omnipresent) objects for Saaremaa people in the closest environment. Nevertheless, they might have also been valued for utilitarian purposes or even for more abstract reasons.

Keywords: *Birds, Bronze Age, Estonia, Saaremaa*

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Bird exploitation in Viljandi (Estonia) from the Late Iron Age to the Early Modern Period (850–1700)

Viljandi, a small town of medieval Livonia, present-day southern Estonia, was founded soon after the conquest by the crusaders in the 13th century. The Estonian prehistoric hill-fort was replaced by castle of the Teutonic Order that became one of the strongest castles of medieval Livonia. The prehistoric settlement was deserted and new town was established nearby. Viljandi lost its importance during the 16th/17th century wars.

Archaeological excavations over the last decades in different parts of Viljandi have unearthed a vast amount of faunal remains, including bird bones. The latter have now been studied by morphological characteristics, with focus on recording the species, detecting taphonomical and pathological features, and determining age and sex where possible.

The analyses have shown that half of the bird remains belong to domestic chicken, while geese, ducks, birds of prey, wild galliforms, passerines and other species form the rest of the assemblage. This variety of species reflects different patterns in food consumption and social background in the prehistoric settlement, and in the medieval town and castle – altogether in over 800 years of history. Moreover, evidence of birds used for other purposes than food – e.g. birds of prey associated with hunting, or using bird bones for crafts – allows us to discuss the differences in status and habits of Viljandi's inhabitants even further, and tackle the various roles birds might have had in those peoples' everyday lives.

Keywords: *Avian archaeology, domestic chicken, Estonia, bird remains*

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Detecting Medieval foodways in the Eastern Baltic through provenance analyses

Zooarchaeological evidence shows that in north-western Europe the marine fishing of herring and cod started to rapidly evolve from around 1000 AD onwards, and that food, especially seafood, was imported to the eastern Baltic since the Medieval period. The dried cod first reached the eastern Baltic probably with Danes at the 13th century, but more intensively by Hanseatic merchants in the 14th–15th century. Yet we lack a comprehensive understanding of the real extent and importance of imported food vs that of local origin. The trade is also evidenced by finds of oyster shells in urban contexts and reach of these imports to rural areas has remained dubious and unexplored to a great extent. Written sources describe the import of (Atlantic) herring, but preliminary zooarchaeological data show that local Baltic herring was mainly consumed. Other commercial fish such as salmon, sturgeon and eel have not been archaeologically well studied, but are often mentioned in historical documents. Despite the importance of fish for human populations, we know little about local fish farming in ponds, especially in northern areas of the eastern Baltic. Besides the written notes about the fish farming, zooarchaeological evidence seems quite scarce. To estimate the ratio of seafood imports in urban vs rural contexts and to refine the early stages of practicing aquaculture in the eastern Baltic region, the zooarchaeological methods and provenance analyses are applied in this study.

Keywords: *Fish, imports, zooarchaeology, provenance, eastern Baltic*

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Utilization of oxen in the Baltic Sea region

This paper presents current knowledge of the utilization of draught oxen in Finland compared with data from Estonia and Sweden. It also discusses the ongoing multisource project examining the issue in more detail. Investigating the oxen castration methods can reveal changes in the cultural influences in the Baltic Sea region. Oxen castration in Finland has been previously examined through metrical analyses of metacarpal bones where cow, bull and oxen bones exhibit different proportions – but only if oxen are castrated as young calves, a method that has been used in Sweden. However, if a bull is castrated as an adult (a method used in Estonia), metacarpal will resemble that of a bull. Finnish medieval bone samples exhibit bull-like oxen metacarpals even if early modern written sources indicate that oxen were castrated here as calves. In the current project these results are examined in greater detail. More comprehensive assemblage of metacarpals is measured and the sex of certain metacarpals confirmed with aDNA. Historical sources are also examined for better understanding of the use of draught animals, oxen and horse, in Finland.

Keywords: *Oxen, castration, Baltic Sea, draught animals, multisource studies*
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Investigating the morphometrics of sheep in North-eastern Europe from the Early Neolithic period to modern native breeds

The effect of economic and environmental changes in the size and shape of animals has widely been discussed. To better approach this topic regarding sheep (*Ovis aries*) in north-eastern Europe and make this material open for discussion, a wide range of morphometric data has been collected. Measurements of post-cranial skeletal elements were recorded in the archaeozoological collections in Estonia, Lithuania and Poland, covering a time span from the Early Neolithic to the Early Modern Period. Ancient data was then compared to the modern native sheep breeds in Estonia, Finland and United Kingdom. As an outgroup, some ancient specimens from Israel, as well as modern Merinos and mouflons were used.

Material from such wide geographical and temporal background, including Stone Age settlements, Bronze and Iron Age hillforts and Medieval towns and castles, are expected to provide a firm basis of sheep osteometric data, and allow to test various hypotheses regarding the effects on the development of sheep populations. These hypotheses contain both social and environmental differences, as well as trade and migrations. Further evidence could be obtained from the comparison with extant native breeds, providing possible links and hints of the shape and size of ancient sheep. Even more, it is of our interest to assess the morphometric affiliation of modern Kihnu sheep and Finnsheep to ancient populations.

Keywords: *Sheep, morphometrics, north-eastern Europe, native breeds*
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Session title:

Long term temporal trends in animal use

Session abstract:

Session Abstract: The purpose of this session is to present broad scale analyses that involve the relationship between different types of human societies and animals. Long-term perspectives are useful to assess cases of change, such as domestication processes, demographic changes in certain taxa, selective processes by humans, extinctions of taxa due to climatic causes or over exploitation. Likewise, there may be long-term stability in the use of some animal populations, allowing discussing whether this is due to the resilience of the habitats or the adaptive management of the species. It is our intention that reviewing cases of different regions, temporalities, which involve several species, related to different procurement strategies (hunting, herding, management) allows to draw conclusions about the diversity in the human-animal relationship that could be useful to address the current problems between society and nature.

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ORAL PRESENTATIONS

Animal presence in archaeological record along the cultural sequence of Arica Highlands, in South-central Andes: From hunther gathers to colonial times

We present the results of the general archaeozoological characterization carried out over 15 sites that report the long history of the occupational sequence of the Arica foothills (2,500-3,800 msm), in the northern Chile. This sequence covers from 10,700 years before the present to the colonial period (16th and 18th centuries). To do this, the bone remains were analyzed using the indexs NSP, NISP, MNI, the identification of present taxa, evidence of anthropic modifications and lanimetric analysis. These data acquire relevance, since they constitute a general and updated synthesis on the antecedents of the archaeological record in the region and allow inserting it in the discussions that are held on the subject in other areas of the south central Andes. It is hoped that this exploratory approach encourages discussion about the presence of animals throughout the human occupations of the highlands and the sustained relationships between animals and high Andean societies.

Keywords: *Faunal remains, meta-analysis, Highlands Northern Chile*

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Use of camelids and processes of change in the South-central Andes from the Early Holocene to the Inca expansion (ca. 10000-500 years BP): Contributions from the Puna of Salta, Argentina

This work focuses on the archaeological study of the processes of change in the use of camelids in different basins of the Puna of Salta, Argentina, in a broad chronological scale (ca. 10000-500 years BP). The camelids were the main resources for human consumption in the highlands of the Andes throughout the Holocene. In the Puna of Salta, relevant sites were registered to study the processes of change in the use of these resources. Among them, we highlight sites such as Alero Cuevas, in the Pastos Grandes basin, with dates in the Early, Middle and Late Holocene, and Abrigo Pozo Cavado, in the Pocitos basin, with dates in the Middle and Late Holocene. Also, in the Ratones basin, the Abra de Minas and Cueva Inca Viejo sites present a archaeological record of the Prehispanic Late and Inca periods. The comparison of the archaeofaunal and contextual evidence of these sites at a regional scale allows us to analyze and discuss topics such as the intensification and domestication of camelids, the consolidation of herding-hunting economies, the caravanning of llamas, the rituals of production and the impact of the Inca Empire in the region. Finally, the results obtained in the Puna of Salta are discussed in the general context of the processes occurring at a macroregional scale in the south central Andes.

Keywords: *Camelids, South central Andes, Puna de Salta, Holocene*

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Changes in the exploitation of animal resources at Punta Teatinos, semi-arid coast of Chile (29 ° 55'S - 71 ° 15'W): A crossing of malacological, ichthyofaunal evidences and terrestrial and marine vertebrates from 3,500 BC until 1450 AD

Punta Teatinos is a settlement of great relevance for the prehistory of the Chilean Semi-arid North. This site presents four occupational moments and three large temporary blocks: Late Archaic or LA (3500 to 3000 BC. and 2000 to 500 BC), Early Ceramic Period or ECP (500 to 1000 AD) and Late Intermediate Period or LIT (1000 to 1459 AD). The objective of this work is to identify and hypothesize about similarities and differences in the exploitation of malacological, ichthyological and faunal resources in general from Punta Teatinos. The malacological evidence indicates a change in the harvesting patterns between the LA and ceramic times. For archaic moments the observed harvesting is oriented towards Choromytilus chorus, Protothaca thaca, Mesodesma donacium, among others. For ceramic times, Mesodesma donacium dominates over the rest of the species. The ichthyoarchaeological evidences for the LA are diverse, being the species Trachurus murphyi the most represented. For the ceramic periods, a greater variability of taxa is observed, increasing the presence of Genypterus sp. In the case of marine and continental vertebrates during the LA, birds, pinnipeds and camelids were consumed in very low amount. Fort the ECP the number of debris in general ostensibly decreases, increasing again fot the LIT. These data indicate changes corresponding to an intensification phase during the LA in the exploitation of almost all of the available resources that, during the ECP and in the hand of an increase in the vegetal collection, are substantially modified.

Keywords: *Late Archaic, Late Intermediate Period, shell mound, Pacific, Chile*

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The care of lama herds in Quebrada de Humahuaca, Jujuy, Argentina: A journey throughout time 900 years ago

The care of lama herds during the pre-Hispanic period has been matter of long debates in all researches focusing on this problem. Among the most relevant questions that these works introduce, there is one that focuses on the uses given to these animals and what type of products were used with main intensity. The relevance of llama (Lama glama) for human communities was indispensable since it provided meat, fiber, bones for instruments production, transportation and everything that regards rigorously their ritual aspects. In our research we focus on how this manipulation was achieved in northern region in Jujuy province, Argentina, known as Quebrada de Humahuaca. In chronological terms, we propose a sequence of analysis of 900 years. By means of practice of the suggested methodology in the archaeo-faunistic analyzes, we determined aspects that allowed us to obtain results revealing the ages of offered-in-sacrifice animals, fact that allows us to discuss the possible reasons by which this type of strategy was implemented throughout time.

Keywords: *llama herd, Humahuaca Canyon, load animal transportation, fiber, meat*

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Camelid introduction to the Pacific coasts analyzed through behavioral ecology framework

Recent zooarchaeological and stable isotope analyses confirm that from at least the Early Intermediate Period until the Spanish Conquest, there was small-scale camelid husbandry throughout the Pacific coast. However, it remains unexplained as to why camelids were introduced, and what purpose their introduction served. It is assumed that the introduction of large mammal species originating from the Andean highlands, heavily affected the environment and human behavior. This study reveals two separate adaptive processes that happened after camelid introduction. First, animals adapted to their new, warmer ecosystem at the lower altitude through decreased body size - but this adaptation was not behavioral. Second, while applying the behavioral ecology (BE) theoretical framework, coastal human population's adaptation could be explained with two BE models: "niche construction theory" or "costly signaling theory". Humans created the new environmental "niche" while changing the organization of natural resources in a way to sustain both maize agriculture and small-scale camelid husbandry to benefit their subsistence. "Costly signaling" means that owning camelids along the coast, even though it may have brought little profit, resulted in increased social importance. These two adaptive strategies would additionally explain why numerous camelid bone assemblages were found mainly within ceremonial centers, not residential areas.

Keywords: *Camelids, behavioral ecology, coastal Peru*

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Temporal trends in faunal exploitation by hunter-gatherers in the central pampean dunefields of Argentina

The subsistence of hunter-gatherers in the Pampas region for the last 12,500 years BP has been defined almost exclusively on the zooarchaeological record. However, for the construction of the trends in the diet, some areas of the region did not provide relevant archaeofaunal information. The main goals of this presentation are to highlight temporal variation in the exploitation of faunal resources and to propose the first subsistence model in shallow lake environments in the Central Pampean Dunefields during the Holocene. We report and integrate novel quantitative faunal information and index of diversity and abundance from four stratified archaeological sites (La Susana 1, Laguna de los Pampas, Cabeza de Buey 2, and Huencú Nazar). The chronological range of these archaeological contexts include the early Middle Holocene (7400-6800 years BP), the late Middle Holocene (5900-4100 years BP) and the Late Holocene (3000-500 years BP). The results indicate an outstanding relevance of the larger artiodactyl (Lama guanicoe) and a breadth of diet that varied over time, which is linked with the site functionality and the dynamics of this lake environment. During the beginning of the Middle Holocene the highest values of diversity suggest the exploitation of a wide variety of species. During the second part of the Middle Holocene and in the Late Holocene hunter-gatherers concentrated on the exploitation of the Lama guanicoe, with a secondary importance of the smaller species. In the last part of the Late Holocene the importance of Lama guanicoe decreased slightly. These trends in faunal exploitation show certain similarities with other areas of the Pampas region.

Keywords: *Faunal variation, dunefields, Pampas*

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A biometrical study of the evolution of pig domestication in Italy

This aim of this paper is to analyse long-term trends of the process of pig domestication carried out by prehistoric communities of Italy. In the past, a series of issues have hindered studies on the emergence of pig husbandry as a new cultural and economic phenomenon in the Italian peninsula, namely the intrinsic difficulties in understanding such process in the archaeological record, the scarcity of well-dated evidence, and the local focus of most studies carried out so far. In this paper, the following research question will be discussed: does the current hypothesis of a mixed origin (local and introduced) of pig domestication in Italy hold to the scrutiny of the analysis of a larger sample, both in terms of actual data and geographic/chronological coverage? To this end, the origins of domestic pigs in the peninsula are analysed through the comparison of biometrical data from several Italian sites, from Upper Palaeolithic to Bronze Age times, in order to detect patterns of regional and chronological change. The results so far indicate that there is no clear separation between wild and domestic populations in early and middle Neolithic times, whereas a change in pig management can be observed at least from the Late Neolithic onwards. Possible explanations for these observations are the domestication of native wild boar, and changes from loose management to close domestic control of pigs in later Prehistory.

Keywords: *Biometrics, pig domestication, Italy*

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Economy, diet and animal resources exploitation trends in Prehistoric Sardinia (3rd-2nd millennium BC): New archaeozoological data from Neolithic Puisteris and Chalcolithic-Nuragic Cuccurada (Mogoro, Italy)

The purpose of this paper is to present the variation of the ecological and economic features of the human groups that inhabited a vast area of western Sardinia throughout a time span of more than 2,000 years, from the beginning of 3rd to the end of 2nd millennium B.C. The examined remains come from the sites of Puisteris -a Late Neolithic settlement (Ozieri facies)- and Cuccurada-Mogoro. In this latter, a Chalcolithic fortified settlement (Monte Claro facies) was followed by a Bronze Age polylobed nuraghe whose remains testify the animal exploitation both during the life phase of the structure and during sporadic frequentation after its collapse in Final Bronze. Through the study of more than three thousands archaeozoological remains coming from these four different assemblages we trace changes in animal exploitation, in procurement strategies and in resources management, either as a result of responses to the ecological evolution or to different socio-economical conditions.

Keywords: *Procurement strategies, animal exploitation, prehistoric*

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Exeter from fort to city - an urban case study

This paper examines changing trends in management of the animals used to feed the city of Exeter (UK) from when it was first established as a Roman Fortress and until the late 18th century. The results incorporate the faunal material from 10 different urban excavations and try to answer a range of questions including how changing function and population density affect herd structures and butchery practices. Furthermore, it steps away from using single excavations as being representative of an area of the city or the city itself, but rather treats the whole city as a single site allowing the archaeology to dictate how the faunal material should be analysed and interpreted.

Keywords: *Animal managemement, Roman fort, Exeter*

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From the Early Neolithic to the Medieval period - archaeozoological studies of the animal remains discovered at the multicultural site Miechów 3 (Lesser Poland)

Studies of changes in livestock management, a significant focus in the field of prehistory, have already contributed valuable information to archaeology, but many unsolved large questions remain to be further investigated. This is especially true in the case of southern Poland, whose potential is still so little explored, as evident by the lack of synthesizing archeozoological publications, compared to what has been done for the Kujawa region, for example. The lack of synthetic archaeozoological papers about southern Poland arises from two factors: the absence of well-dated rich faunal materials and the incompleteness of the earlier studies, sometimes consisting of only working reports, often unpublished. An assemblage to fill this gap is the material obtained during several years of field research carried out at the newly excavated multicultural open settlement Miechów 3 (Lesser Poland). The excavations provided about 20,000 animal bones and teeth, discovered in features dating from the early Neolithic, the Eneolithic period, the Early and Late Bronze Age, the Pre-Roman period, the Roman period, and the early Middle Ages (XI-XIII century). Because the bone material discovered during excavations is so abundant, it is possible to assess the relative importance of individual mammalian species to transport, agriculture, trade, and symbolic culture for the different communities inhabiting this site for millennia. Thus, it is possible to present substantial observations of how different groups of people have used the surrounding environment, and these interpretations help us better understand the processes of changing human adaptation in southern Poland.

Keywords: *Stock management, resource use, Lesser Poland*

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The grass is always greener? Change and continuity in husbandry strategies and landscape organisation in the Late Medieval and Early Post-Medieval English countryside

The late Medieval and early Post-Medieval periods in England are associated with significant agricultural transformation and improvement. The term ‘Agricultural Revolution’ is often applied to this era, though it remains contentious and has been assigned very broadly to numerous periods from the 16th to the 19th century. While the appropriateness of the term is still debated, zooarchaeological evidence from predominantly urban locations has demonstrated clear alterations in livestock size, shape and herd profiles from at least the 15th century, suggesting change in husbandry strategy during this time. Another considerable transformation occurring during the late medieval period was significant anthropogenic landscape change in the form of enclosure. It could be argued that extensive enclosure during this time brought about greater control over livestock food, disease and breeding, and therefore potentially the means of improving herds. This study consequently aims to investigate how, and indeed if, enclosure affected the selective processes employed by humans by comparing zooarchaeological data from the late medieval and early post-medieval periods to contemporaneous

landscape and historical evidence. In addition, exclusively rural sites located across England have been selected for study in order to provide evidence for livestock change at primary centres of animal rearing. The geographic location of case studies, in areas of varying terrain and enclosure mechanisms, will improve our knowledge of how and when change was propagated across the country. Overall, this research provides a more accurate indication of how the enclosure process may have affected livestock farming decisions, and therefore the improvement of livestock in the late medieval period. This increased knowledge regarding the timing and causes of livestock change helps to foster a greater awareness of the development of English husbandry, agriculture, and economy.

Keywords: *Livestock improvement, Medieval England, agricultural revolution*

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Testing the 'Broad Spectrum Revolution': Assessing temporal trends in faunal exploitation in the Southern Levantine Natufian and PPNA (15,000 - 10,500 cal. BP)

The nature of the drivers behind the emergence of the 'Neolithic Revolution' and the respective push and pull of climatic and human factors have been hotly debated. Observed changes in the exploitation of smaller or more resilient prey animals prior to the introduction of farming have been used as the cornerstone of theoretical frameworks. Traditional 'Broad Spectrum Revolution' (BSR) theory interprets this shift as an intensification response to increasing human population pressure and over-hunting, a coping strategy that culminated in farming. In contrast, the more recent 'Niche Construction Theory' sees these changes as an innovation enabled by an ameliorating climate. The southern Levant has proven a fertile testing ground for BSR theories. However, previous studies have generally focused on a limited number of assemblages from the Mediterranean environmental zone. It is an open question whether these trajectories in faunal exploitation are more broadly representative. This paper presents the results of a pilot study which takes an expansive, meta-analytical approach to exploring the nature of faunal change in the southern Levantine Natufian and PPNA. By using exploratory statistical methods such as correspondence analysis, over 60 faunal assemblages from across steppic and Mediterranean environments have been analysed. Results fail to meet the expectations of existing theory, suggesting the action of factors not yet considered within these major frameworks. This 'big data' approach highlights the importance of considering the role of environment when investigating temporal change in faunal exploitation.

Keywords: *Natufian, PPNA, meta-analysis, broad spectrum revolution, niche construction theory*

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The domination of terrestrial snails "albino" in the prehistoric sites of Tunisia during the Holocene: A human strategy?

The list of the terrestrial malacofauna discovered in the "rammadiyat" (ramad = ash, local name or "escargotières") is very rich. It varies from one site to another. From the typical Capsian until the Neolithic, the "albino" shells predominate. Sometimes, they present more than 90% of the malacological stock, as for example in the sites of Kef Ezzahi or Oued Nadhour (right bank). They are represented by Sphincterochila candidissima. A small specimen, resistant to the hot climate. When the temperature rises, it clings to tree trunks and plants as a "cluster". This behavior facilitates its collection in large quantities. The discovery of candidissima shells with a calcified epiphragm in Kef Ezzahi's "rammadiya" confirms this idea. The situation of the epiphragm just at the entrance of the test, at the peristome level, would indicate a collection at the beginning of the rest phase (of the estivation). This is a targeted collection at a specific time of the year (late spring and early summer) to meet part of the diet of Captian human groups.

Keywords: *Malacofauna stock, diet, prehistoric Tunisia*

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Livestock through the ages: Long-term trends in animal husbandry in two regions of Sweden from Bronze Age to the Middle Ages

General trends in animal husbandry in Sweden have been established for decades, but assumptions have been based on sites from regions with different conditions. Large scale excavations the latest decades in the region of Scania in southmost and Uppland in Middle Eastern parts of Sweden have resulted in data sets of animal bones from many sites. This study aims at tracing trends in animal husbandry reflected in the abundance of bones of different kinds of livestock and body size through osteometry. The changes in animal husbandry are analysed in relation to regional conditions in climatic, environmental change and cultural development. Certain trends are inter-regional, such as increased importance of pig husbandry after the 5th century AD, which could be a result of changed agriculture practice and increased importance of cultivation as well cultural change in cuisine and preferred meat. In the southernmost region large changes in animal husbandry can be noticed and could be explained by being closer to the continent with contact and influence from the Roman empire.

Keywords: *Animal husbandry, osteometry, Bronze Age, Middle Ages, Sweden*

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Human adaptations to the altering faunal communities present in the Late Pleistocene and Early Holocene of Eastern Jordan

This paper presents results from the Qa' Shubayqa in Eastern Jordan where excavation and survey have identified a series of sites spanning the Early Natufian to Late Pre-Pottery Neolithic A (~14.5 - 10.5 kyr cal. BP). This chronological period, covering some 4000 years, witnessed fluctuating environmental conditions as the climate oscillated between warmer and wetter conditions of the Bølling and Allerød interstadials, colder and drier environment associated with the Younger Dryas and the gradually warming conditions of the Early Holocene. Additional local influences on resource accessibility included the sedimentary infilling of the Qa' which reduced water availability throughout

the year. These factors impacted on the fauna present and comprised the prey on which humans depended. Initially the environment was optimal and humans could hunt the thriving gazelle herds and target frequent waterfowl that passed through the region in the autumn and spring on migration with other wintering species were present in the coldest months of the year. Gradually environmental changes affected bird migration patterns with passage migrants decreasing in number. The herds of gazelle were still present but changes in the mortality profiles of these animals suggest that hunting focused more on adults rather than juveniles. There was not a sharp decline in resource abundance but humans shifted hunting strategies to compensate for changes in prey availability. The presence of dogs in large numbers in the PPNA is one of the most important changes visible in the archaeological record perhaps reflecting the need of the humans to diversify their hunting approaches.

Keywords: *Late Pleistocene; Early Holocene; Hunting strategies; dog domestication; bird migration*

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Session title:

Social networks and animal ageing and sexing

Session abstract:

The ageing and sexing of animal remains in zooarchaeological research is imperative for understanding the role of animals in subsistence strategies for past populations. Determining the age and sex of animals is significant because these data allow us to realize the biological and cultural life stages of animal groups. These life stages could have placed affordances and constraints on human populations in relation to practices of birthing, rearing, butchering and deposition of animals in special contexts.

Recent research in zooarchaeology has more effectively addressed how the age and sex of animals can shed light on secular and ritual practices. The objective of this session is for participants to consider the social role of animal age and sex both for individual animals and for herd profiles to better understand how the involvement of animals in different practices was important for economic capital and religious veneration. Eduardo Kohn (2007) has discussed how the 'anthropology of life' can be a powerful tool when interpreting patterns among material records. We hope that by considering life histories of animals and animal groups we can make more substantial interpretations for past practice involving animals.

We hope that participants working on already existing ageing and sexing methods can contribute. Also, those researchers that are developing new ways of determining or addressing age and sex among animal groups are encouraged to participate in this session.

Organisers:

Aleksa K. Alaica, University of Toronto (aleksa.alaica@mail.utoronto.ca)

Deborah Ruscillo, Washington University (druscill@wustl.edu)

ORAL PRESENTATIONS

Ageing and sexing animal remains: Social insights from ancient Greece and Peru

This paper will be an exploration through the techniques of ageing and sexing animal bone remains to draw new insights from archaeological assemblages. Both authors work in distinct regions and they each address animal remains from their own contexts with ageing and sexing methods. This introduction will be an opportunity for thoughtful conversation around topics of power and social interaction through age and sex data to address how people in the past where interacting with and exploiting animal groups.

Keywords: *Cross-cultural comparison, social dynamics, power* Aleksa K. Alaica, University of Toronto. Deborah Ruscillo, Washington University.

Rock Hyraxes (*Procavia capensis*) from Middle Stone Age levels at Blombos Cave, South Africa

Blombos Cave in South Africa contains some of the oldest evidence for symbolic behaviour by anatomically modern humans. The ~100 ka Middle Stone Age levels at Blombos Cave contain numerous rock hyrax (Procavia capensis) remains, in additional to other large animals. It is often ambiguous to interpret rock hyrax remains from archaeological deposits deriving from cave and shelter sites in southern Africa as the agent or agents of accumulation may be difficult to establish. The analysis indicates that although a few specimens show evidence for raptor and carnivore accumulation. Rock hyraxes have a short and well-defined period of sexual activity triggered by photoperiod, and not annual cycles in rainfall or temperature. The period of sexual activity varies in southern Africa, and it is progressively later at lower latitudes. In the southern Cape, where Blombos Cave is situated, rock hyraxes currently give birth between September and October. In the southern Cape, these birth peaks coincide with the local vegetation (fynbos) being in prime condition following the winter rains. Using teeth remains to age rock hyraxes, humans preyed on these small mammals during different times of the year.

Karen L. van Niekerk, University of Bergen.
Shaw Badenhorst, University of Witwatersrand.
Christopher S. Henshilwood, University of Witwatersrand.

A Neolithic feast: New evidence for consumption of wild boar in the Central Zagros, Iran

At the early Neolithic site of Asiab (9660-9294 cal. BC) a pit, located in the centre of a large communal structure was discovered during renewed excavations at the site. The pit contained the skulls of at least 19 wild boars carefully placed in a pit that was subsequently sealed. Alongside a small collection of postcranial Suidae remains, antler from red deer and the skull of a brown bear were also concealed with the skulls.

The wild boars included both male and female animals and ranging in ages. Some of the larger canines of the males also appear to have been deliberately removed. Such a collection of fragmented but near complete skulls and mandibles, represent an opportunity for an in-depth study of the age and sex of hunted wild boar, based on the current methodology on teeth eruption and wear.

Focus will also be on the context of this unique collection of remains, which is unlikely to be based purely in the day-to-day activities of the hunter-foragers, due to the size and composition of the remains as well as the context itself. The evidence from Asiab points to a group of ritually interred bones and hints at communal activities reinforcing social cohesion at a time when human society was developing agricultural subsistence strategies.

Keywords: *Wild boar, feasting, early Neolithic, population profile* Pernille Bangsgaard, Copenhagen University.

Lisa Yeomans, Copenhagen University.

Camelids and social interaction in Middle Horizon Cusco: Assessing herd profiles at Ak'awillay, Peru

The age profiles of herd groups form an important line of evidence to discuss trade interaction and social networks in the past. At the Middle Horizon site of Ak'awillay in the Cusco region of Peru, llamas and alpacas dominate the faunal record during an integral phase of long distance exchange and the reformulation of the political landscape in the Middle Horizon period. The expansion of the Wari from the Ayacucho Basin has been argued to change the kinds of relationships that existed in the Cusco region, however evidence from Ak'awillay shows that shifts in social and political practice preceded the Wari proliferation. Interestingly, the herd age profiles of New World camelids show consistency through time at this multi-component site. This paper will argue that the continued use of camelids in feasting practices allowed for stability in the preceding period of Wari contact, which enabled changes to occur in the kinds of feasting vessels from communal bowls to individualized containers. It is the overall shift in feasting vessels yet consistency in the kinds of camelid age groups that were being exploited that could have provided a level of stability for continued contact with Ak'awillay and distant locales. The camelid age data provides an important contribution to conversations around long-term practice and it sheds light on the kinds of interpretations that can be made about animal life histories and human socio-political practice.

Keywords: *Animal life histories, camelids, political stability*

Aleksa K. Alaica, University of Toronto.

Véronique Bélisle, Millsaps College.

Sheep castration in the Medieval and Modern periods in Europe: Modalities, demographies and archeological evidence

"There are no livestock species in which as many males are deprived of the parts essential to generation as among the beasts of wool", wrote l'Abbé Carlier in his 18th century treatise on sheep husbandry (Carlier, 1770, p.65). And indeed, both accounting documents and agricultural texts of the medieval and early modern periods testify to the quasi-systematic gelding of male lambs in sheep flocks: typically, rams represented less than 5% of the male population, which was overwhelmingly comprised of wethers.

This fact - that that the vast majority of male sheep bones in historical archaeological samples actually stem from castrated animals - has perhaps been underestimated by zooarchaeologists. Compared to the extent of the practice, surprisingly little archaeological research has been devoted to the topic of sheep castration. It must be said that the skeletal identification of gelded animals is notoriously difficult: as far are we are aware, the presence of castrated sheep has never been undisputedly demonstrated in archaeological remains.

This presentation aims to raise awareness of the omnipresence of wethers in medieval and modern European assemblages. The case-study of an unusual assemblage of 18 complete ovine skeletons dated to the 17th-18th from Achères (France) allows us to demonstrate, we believe conclusively, that all males of the sample were castrated. Expanding on this example, we explore through historical texts the how, the when and the why of sheep castration, and discuss the demography and sex-ratios of medieval and modern flocks.

Annelise Binois, Université Paris 1 Panthéon-Sorbonne.

Application of osteological measurements and nonmetric traits to assess the ontological age of ahite-tailed deer (*Odocoileus virginianus*) in archaeological assemblages.

In 2012 a thesis project was initiated investigating the hypothesized management of white-tailed deer (*Odocoileus virginianus*) by the pre-Columbian Maya, using osteometrics and size-index-scaling. This paper addresses the osteology of a modern sample population of known age and sex that was studied for comparison with archaeological samples derived from excavations in Yucatan, Belize, Guatemala, and Honduras. Measurements from the modern specimens were found to vary between sex and age cohorts but were consistent between individuals in each cohort. The measurements of these specimens indicate that bone growth may not be symmetrical on all planes, that measurements of bone depth vary between age cohorts and could be diagnostic of ontological age of individual specimens. This in turn suggests standardized depth measurements may be used to assess age at death for archaeological samples. Examination of the modern specimens also identified two nonmetric traits, fusion of the ulna to the radius, and variability in the location and plane of measurement of the smallest diameter (SD) on the metatarsal that might also be used to identify older adults in an assemblage.

Rick Cantryll-Stewart, University of Nottingham

Understanding caprines perinatal mortality at the early Neolithic site of Els Trocs cave (Bisaurri, Huesca, Spain)

Perinatal mortality of caprines has been acknowledged as a common trait of the faunal assemblages associated with early Neolithic farming communities of the Iberian Peninsula but up until recently, few attempts have been made to differentiate between fetouses and neonates. Martín & García-González (2015) have used morphological and osteometric criteria that in the case of the latter are based on different age predictor equations (Richardson et al 1976; Santucci et al 1993). In this paper we aim to work with log ratios to detect size and shape variations among the perinatal remains of caprines recovered at the Els Trocs cave (Bisaurri, Huesca, Spain), a site located in the central Pyrennes above 1500 m.a.s.l. Lengths and breadths of the main long bones are compared to standard measurements of an individual in the fourth month of gestation of the Rasa Aragonesa breed (García-González 1981). The differences observed among the three phases of occupation of the site (6th-4th millennium cal. BC.) will help to detect changes in the mortality patterns of perinatal individuals that may be related to the control of birthing season and improved husbandry techniques as the Neolithisation process advances in this high-mountain environment.

References:

GARCÍA-GONZÁLEZ, R. (1981) - Crecimiento del esqueleto en corderos de raza rasa aragonesa ecotipo ansotano. II. Esqueleto apendicular. Publicaciones del Centro pirenáico de Biología Experimental. 12, pp. 125-142.

MARTÍN, Patricia; GARCÍA-GONZÁLEZ, Ricardo (2015) - Identifying sheep (Ovis aries) fetal remains in archaeological contexts. Journal of Archaeological Science. 64, pp. 77-87.

RICHARDSON, Carol; HEBERT, C. Nancy; TERLECKI, S (1976) - Estimation of the development age of the ovino fetus and lamb. Veterinary Record 99, pp. 22-26.

SANTUCCI, V. L.; KULLER, J. A.; BATTELLI, A. F.; LAIFER, S. A.; EDELSTONE, D. I. (1993) - Fetal Metatarsal Length: An Accurate Predictor of Gestational Age and Weight in the Ovine Fetus. Gynecologic and Obstetric Investigation. 35, pp. 76-79.

Keywords: *Perinatals, log-ratios, size, shape, Neolithisation*

Marta Moreno-Garcia, Instituto de Historia – CSIC.

No teeth, no age? A proposal for chicks ageing

Young domestic fowls are quite rare in archaeological material and then difficult to interpret. This problem is mainly due to the bird's ageing difficulty. Indeed, as birds have no epiphyseal bones and, of course, no teeth, the main part of our classical ways to determine ages are useless. We only can base a reflection on bones' growth. Indeed, until its adult size, every bird skeleton gradually grows, more or less, according to a pattern which is possible to observe. However, while mammal bones' development is ended by epiphyses fusion or reptile's one never ended until death, birds' growth is limited but not really by a well observed epiphyseal process. Our proposal is based on that simple observation: chicks are small individuals of which bones' length is only a part of adults' one. Moreover, as chicken is a domesticated bird, many breeds exist and we need to find a specific approach to overcome the morphotype diversity problem. In this way, the comparison and mathematical relation between adult and young birds' bones' length could be a manner to estimate chicks' age at death. The aim of such a method is to better understand breeding places and chicken's consumption and, also, to observe birds' osteological development.

Michaël Seigle, University of Lyon 2. Thierry Argant, Eveha.

"…of everything that is male they offer nine heads…": Age and sex of animals in Old Norse ritual practice reflected in written sources and ritual bone depictions

In ritual practices involving sacrifices of animals in many religions as much significance, if not more, are on the age and sex of the animals, as the taxa. In most earlier zooarchaeological studies of ritual practice in Iron Age Scandinavia focus have been on taxa and body parts and to less extent on age and sex. In this study the age and sex of animals in ritual depositions from the 6-11th century AD is compared to the written sources of Old Norse religion. The written sources indicate a clear preference of males in sacrifices while the archaeological record reveals bones from female animals frequently occur at some ritual contexts. The age of sacrificed animals is often undefined in the written sources, while the archaeozoological record indicate a large variation depending on the ritual context. Some trends can be noticed in the ritual practice reflected in the animal bones, with a preference of large and full grown, prime animals, such as horse and cattle, at large, prestigious sacrifices and communal rituals at specific sites in the landscape, while rituals at farms and the household level to a large extent involved smaller livestock and juvenile animals.

Ola Magnell, Swedish National History Museeums.

Age estimation of horse teeth

The more accurate an estimation of the age at death of an animal is, the more useful it will be to determine the seasonality of a site or to improve the resolution of the age distribution of a death assemblage. For seasonality studies it is obvious that the very young animals serve best since a certain margin of error translates into little absolute error and therefore little error in the determination of the season. With this in mind, our late friend and colleague Philippe Morel had collected more than 20 horse skulls from animals with known age, all younger than one year. From these, 8 animals between 2 weeks and 6 months of age, one with 9 months, and one with 12 months were chosen to be presented. In addition, archaeological examples from a Swiss Magdalenian site are shown as well when available. Starting with the age class of two years, only archaeological material is presented, because no reference material with precise age is available. The age estimation of these teeth was performed by establishing a series of progressive wear stages that translate into yearly age classes. This is based on the assumption that the older animals were hunted at the same time as the foals, i.e., in spring and up to early summer. Therefore, the age classes of 2, 3, 4, etc. years would translate to the number of years plus 0-3 months. The fact that (almost) no intermediate wear stages were found seems to give credibility to this approach. Above the age of 8 years, it is deemed that the yearly age classes could not be established anymore with enough confidence.

Warner Müller, Université de Neuchâtel.

POSTER PRESENTATION

Age estimation on Patagonian penguins (*Spheniscus Magellanicus*) from modern skeletal remains

The Spheniscidae are pelagic birds that represent up to 80% of the bird biomass in the Southern Hemisphere oceans. In continental Patagonia, the nesting areas of the Magellanic penguin (Spheniscus magellanicus) include hundreds of thousands of individuals. After reproduction on the Patagonian coast during the southern spring-summer, these birds migrate to the north, reaching littoral areas of Buenos Aires province (Argentina), Uruguay, and southern Brazil. Even though their remains have been recovered in archaeological sites in Chile, Argentina and Brazil, there are no bone indicators to estimate the age structure represented in the fossil assemblages. For this reason, we developed a project to establish these indicators from penguin modern samples recovered from the coast of Argentina, both in nesting and resting areas along their winter migration route. The samples analyzed include individuals characterized as chicks, juveniles, adults, depending on the characteristics of the plumage. Preliminary results obtained on five elements (humerus, coracoid, femur, tibiotarsus and tarsometatarsus) allow to clearly differentiate these age classes. These studies contribute to discussing issues such as the seasonality of human occupations and exploitation strategies of the species throughout its range of geographical distribution. Moreover, as this species is anatomically similar to the Humboldt penguin (S. humboldti) and the South African penguin (S. demersus) we believe that our results will be also applicable to the zooarchaeological analysis of these species.

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Session title:

Contextual taphonomy in theory and practice

Session abstract:

Recent zooarchaeological advancements highlight the need for greater integration of stratigraphic and contextual data with zooarchaeological and taphonomic data to explain intra-site variability. The Contextual Taphonomy approach combines these data to clarify the 'life history' of a faunal sub-assemblage in a given context. Animal remains record multiple chapters in the life histories of assemblages, from species selection and use, to deposition, and finally, post-discard stages. Most importantly, reconstructing depositional histories has great potential to illuminate variability among site features as archaeofaunal remains are normally ubiquitous and are excellent indicators of site-formation processes, refuse behavior and activities, and by extension, site type and occupation intensity. Additionally, establishing the "normal" depositional signature for one or more sites improves the identification of deposits that deviate from the norm—for example, ritual caches and feast remains.

While becoming more common, intra-site depositional studies are still not widespread in zooarchaeology. This approach was extremely useful in our own research of the Near Eastern Epipaleolithic-Neolithic transition, as intra-site faunal patterns signaled refuse behavior, site organization, site-occupation intensity and site type (e.g., refs 1–3). In this session, we aim to bring together researchers who employ intra-site faunal analyses to discuss ideas and practical experiences, and encourage proposals of new frames of reference that may extend sub-assemblage life histories or aid their comparison across sites. We invite paper submissions from zooarchaeology and related fields and welcome theoretical contributions and case studies from all places and periods.

References:

Yeshurun R., Bar-Oz G., Kaufman D., Weinstein-Evron M. 2014. Purpose, permanence and perception of 14,000-year-old architecture: Contextual taphonomy of food refuse. Current Anthropology 55: 591-618.

Yeshurun R., Bar-Oz G., Nadel D. 2013. The social role of food in the Natufian cemetery of Raqefet Cave, Mount Carmel, Israel. Journal of Anthropological Archaeology 32: 511–526.

Meier J.S., Goring-Morris A.N., Munro N.D. 2017. Depositional histories of faunal remains from the Neolithic cultic site of Kfar HaHoresh, Israel. Journal of Anthropological Archaeology 48: 233-249.

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ORAL PRESENTATIONS

From meat to meals to middens: Intra-site analysis of faunal refuse management at Neolithic Kfar HaHoresh

During the agricultural transition in southwest Asia, a major shift occurred in the use of space. More invested site features and more differentiated functional areas arose as farming life-ways developed. By the Pre-Pottery Neolithic period, changing patterns of site use are evidenced by the greater use of discrete middens at diverse sites, including locales used primarily for ritual activities. More studies of refuse management related to the use of middens are needed to better clarify how space was organized and used during the Neolithic Transition. This paper presents the analysis of midden deposits with faunal remains at Kfar HaHoresh (10,600–8,700 cal. BP)—the only Pre-Pottery Neolithic site in the southern Levant that served a primarily ceremonial function. The contextual taphonomy method is used to reconstruct histories of animal selection, use, and subsequent deposition of remains in two different middens at the site. These results reflect intra-site and intra-context variation in depositional practice. This reveals how norms of refuse management were manifested at a ceremonial site and can clarify the interrelationship of ritual and habitation site use during this pivotal transition.

Keywords: *Contextual taphonomy, Neolithic, middens, ritual practice*

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Hare bones, structured deposition, and ritual in a Neolithic court tomb at Parknabinnia, Ireland

CL153 is an atypical, two-chambered Neolithic court tomb at Parknabinnia, Co. Clare, Ireland, which was excavated in the late 1990s. The site is located in the Burren, a limestone karst region, as a result of which prehistoric bone preservation is much better than is usually found in western Ireland. The excavation yielded substantial quantities of human and animal bone and the faunal assemblage consisted of over 2000 identified fragments of animal bone. This was dominated by hare (*Lepus timidus hibernicus*), with a NISP of 1259, representing an MNI of 38 individuals and distributed between the two chambers. Dating of these bones shows them to have been contemporary with human remains from the two separate chambers of the tomb. Most interestingly there is evidence for deliberate human deposition of both partly dismembered and whole hares in the tomb, with different practices being undertaken in the two chambers. This paper will discuss the results and interpretation of these remains, considering the depositional history of the faunal remains, their relationship to the human remains and the ritual practices identified as a result of the analysis.

Keywords: *Lepus, Neolithic, chamber tomb, Ireland*

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Shacks and scraps: Understanding Middle Epipaleolithic site structure in the Southern Levant through taphonomic analysis of faunal refuse

We explored the spatial organization of the open-air Middle Epipaleolithic site of Neve David (Haifa, Israel) through macro and micro contextual taphonomy of ungulate bones. The Epipaleolithic (ca. 23,000-11,500 cal BP) of the southern Levant is renowned for the emergence of complex and sedentary hunter-gatherer societies during the terminal Pleistocene. Late Epipaleolithic Natufian sites have characteristics indicative of differential site organization and social complexity. Emerging research from Early and Middle Epipaleolithic sites suggest this behavior began prior to the Natufian and should be reevaluated against preceding evidence in the same area. Therefore, we aimed to further understand site structure during the Middle Epipaleolithic by examining faunal refuse patterns from the site of Neve David.

Excavation of this pre-Natufian Geometric Kebaran site revealed a high density and diversity of finds, in situ activity areas, and possible combustion and stone architectural features. Animal remains are abundant in most of these contexts, suggesting they can be used as spatial indicators. Our study incorporated micro and macro zooarchaeological techniques to understand differential preservation and organization of ungulate bones from defined localities of the site. The application of micro analysis through Fourier Transform Infrared spectroscopy assisted in understanding the preservation of bone specimens, augmented by conventional macro taphonomic analyses. Preliminary analysis of the northern and southern areas of the site revealed differential volumetric density and preservation of bone assemblages. These macro and micro observations allow for a more nuanced understanding of bone assemblage formation and site organization, contributing to our overall knowledge of pre-Natufian site structure in the southern Levant.

Keywords: *FTIR, site organization, Geometric Kebaran, Israel*

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Site organization and waste disposal at the beginning of the transition to agriculture: Insights from Nahal Ein Gev II, Israel

Although research suggests that the organization of site structure and waste disposal practices changed dramatically between the Early Natufian and the end of the Pre-Pottery Neolithic B period in Southwest Asia, details about the development of more formalized use of space and waste disposal practices are needed. Here, we investigate these aspects of community organization at the beginning of the forager-producer transition in the southern Levant using zooarchaeological data. In particular, we discuss (1) how the Late Natufian inhabitants of Nahal Ein Gev II differentiated their use of space and activities; (2) whether residents kept their living spaces clean of debris and disposed of garbage in secondary locations; and (3) how garbage disposal differed between mundane versus ritual contexts. Insights from our observations are used to inform broader issues about the emergence of permanent sites and intracommunity organization at the end of the Pleistocene.

Keywords: *Southern Levant, organization of space, site permanence, Natufian*

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Bones around town: Depositional patterns at Azoria, Crete

The intensive collection of environmental remains at the site of Azoria, Crete provides a unique opportunity to examine the use of space and deposition of refuse in a historical Greek settlement. The excavation area included several houses, a large Communal Dining Building, a cultic structure, and exterior spaces. The intentional abandonment of the settlement in the early 5th century BC has left deposits of zooarchaeological material reflecting specific processes of abandonment, refuse disposal, and pre-abandonment activity within a variety of spatial units. These intra-site patterns from Azoria testify to the importance of intensive environmental recovery, even within a big-dig setting. The bones give a taste of what was cooking around town.

Surprisingly, there are few clear taxonomic patterns across the site. Both civic feasts and domestic meals were dominated by goat followed by sheep. It is only through a consideration of anatomical distribution, butchery marks, burning, and other detailed patterns that past activity can be inferred. Zooarchaeological deposits in kitchens vary from those in storerooms or halls, all identified independently from architectural features and ceramic assemblages often left intact on the floors. The large middens associated with the Communal Dining Building contain cuts of meat not usually found

in other contexts. Efficient cleaver butchery was a hallmark of these large-scale feasts. Evidence for sacrificial ritual, where the lower legs and sometimes horns were selectively burned, is abundant in an ash dump from the nearby temple. Small deposits of similarly burned material are the latest remnants left in situ on the floors or within architectural bins of most households. A final feast, perhaps, before saying goodbye.

Keywords: *Feasting, butchery, Crete, household*

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Disentangling taphonomic histories at Old Uppsala, a Late Iron Age central place in Sweden, using Multiple Correspondence Analysis (MCA)

Large zooarchaeological data sets described by multiple variables are hard to overview without a multivariate approach. Such complexity needs proper tools in order to enable analysis of the often many recorded variables, or else significant zooarchaeological understanding of a site might be missed. Multiple Correspondence Analysis (MCA) is applied on animal bones at Late Iron Age site of Old Uppsala, Sweden, to detect waste management at the site and to evaluate the inferential value of MCA, as indicated by earlier research using this technique. The animal bones from Old Uppsala were recently examined; still, any systematic spatial or contextual patterns of disposal of bones within the settlement have been difficult to detect. In this paper, intra-site variation at Old Uppsala is investigated through the distributions of taxa, anatomical parts, age and sex, as well as taphonomic markers from burning, butchery, gnawing, trampling, weathering and post-depositonal attrition. The contextual groups included in this analysis are primary and secondary depositions in post houses, pit houses, wells, pits, hearths and cultural layers. Correspondences and variation within the data, including all above variables, are simultaneously visualized by the chosen statistical technique, MCA, providing a platform to contextualize taphonomic traces at Old Uppsala, and to shed new light on this important Late Iron Age site.

Keywords: *Sweden, statistical analysis, waste management*

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Characterising intra-site variability in the Early Neolithic of Central Europe using bone fracture and fragmentation analysis

Zooarchaeological analysis has huge potential to explain patterns of intra-site variability when combined with contextual information, especially in terms of bone fracture and fragmentation. Bones are susceptible to breakage at many points on their journey from animal to archaeologist, for example during butchery and bone fat extraction, in deposition or redeposition, or in later deposit disturbance. The nature of these processes causes different patterns of breakage, which will thus reflect variance in these processes within an archaeological site. By collecting bone fracture freshness, type, weight and size data alongside a ‘standard’ zooarchaeological analysis, it is possible to separate signatures of, for example, breakage of fresh diaphyseal and cancellous bone for marrow and grease rendering from indiscriminate taphonomic fracture. When combined with evidence for taxa representation, skeletal element abundance, butchery, heat exposure and taphonomy, an incredibly detailed picture of sequences of butchery, deposition and site formation processes emerges which can be analysed on a contextual basis across the site. The utility of this methodology will be shown using case studies from a suite of zooarchaeological analyses of early Neolithic central European sites, performed as part of the NeoMilk project. These examples will showcase the incredible versatility of bone fracture and fragmentation analysis in understanding intra-site variability.

Keywords: *Butchery, NeoMilk, breakage patterns, Neolithic*

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Stories of bones and animals: Taphonomic studies on archaeozoological record of hunter-gatherers' contexts in Tignamar basin, foothills of Northern Chile

The foothills in the Andes of northern Chile (2,500-3,800 msm) has a vast cultural sequence that ranges from hunter-gatherers' occupations of 10.700 years ago to the present.

Most occupations of hunter-gatherers are concentrated in rockshelters and scarcely in open-air sites, both cases have been studied primarily in terms of lithic evidences and rock paintings present in the sites. The archaeozoological remains has recently been addressed and this has allowed the understanding of consumption of animals by these groups. However, due to the fragmentary nature of the bone register and the inherent difficulty in these archaeological sites, the reconstruction of sites' formation histories has become imperative to establish with veracity the evidences of animal consumption and differentiate them from the evidences of taphonomic modifications over the bones. In this opportunity we present the taphonomic histories of two sites located in the Tignamar basin: El Bajo (rockshelter) and El Alto (open-air site), both present occupation dates that oscillate between cal. 10,700 a.p and 5,000 a.p. The methodology consisted of contextual analysis, macro and microscopic analyzes on the bone surface and the variables addressed were: weathering, types of fracture, and presence of plant, animal, biotic, chemical and mineral agents. The research proposed meant opening a new line of work from archaeozoology with an interdisciplinary and collaborative approach. Through this investigation were obtained antecedents on the processes of formation of the archaeological record, especially archaeozoological, and contribute to the understanding of the relationship between the human and the environment in hunter-gatherer contexts.

Keywords: *Taphonomic histories, hunter gatherers contexts, Andean Archaeology*

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From intra-site variation to inter-site comparison in Medieval and Post-medieval Finnish bone assemblages

This presentation aims to examine the intra-site variation found in medieval and post-medieval bone assemblages in Finland and the affect this variation has to the attempts of inter-site comparison of the faunal remains. Most of the animal bone assemblages from urban contexts in Finland consist of mixed slaughter, butchery and kitchen waste. However, there are also few samples representing more selective utilization of animals, including craft activities, ritual deposits and food preparation and consumption. The qualitative differences of these samples and implications of these different types of deposits could have to inter-site comparisons are discussed. For example, the proportion of different species and animal age and sex profiles vary considerably between the different deposits. The aim of the zooarchaeological interpretation is sometimes to reconstruct the past animal population and its utilization patterns. For this goal, it is important to understand the complexity of the deposition of faunal samples.

Keywords: *Historical archaeology, urban refuse, Scandinavia*

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A cow's tale: Understanding post-depositional processes through contextual taphonomy at the site of Ein Zippori, Galilee, Israel (9th to the 4th millennia BCE)

Ein Zippori in the Galilee is a stratified site that was occupied from the 9th to the 4th millennia BC, spanning the transition from early Neolithic villages to the first walled, proto-urban settlements in the region. The large faunal assemblage from the site comprises also of three complete animal burials, which we ascribed at first to ritual activity. In this study, we have applied contextual-taphonomic analysis to one such burial of an Early Chalcolithic cattle, to investigate the potential explanatory power of alternative depositional processes. Use of bone surface modifications, post-mortem changes in carcass position, and comparison of the artefacts and bones in the burial matrix to other contexts at the site have contributed to better understanding of the history of the buried animal, and lent credence to mundane alternative explanations over ritual.

Keywords: *Cattle burial, ritual, contextual taphonomy, Levant*

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Ianir Milevski, Israel Antiquities Authority. Nimrod Getzov,
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Session title:

Animal health in archaeology: Integrating landscapes, populations, and individuals

Session abstract:

Session Abstract: Animal health and well-being are essential concerns for people caring for domesticated animals, but they are also signals of human health and well-being. Zooarchaeologists have long recorded individual pathologies from skeletal remains. This lesional approach is however often limited by the difficulty of diagnosing non-specific lesions, and by the limited scope of results obtained on individual specimens. In this symposium, we aim to address issues of animal health on a populational scale, and to integrate the paleopathological data with other factors of animal lives discerned from archaeological and zooarchaeological data.

Patterns of stress and injury observed in large assemblages may indeed reveal important information about an entire animal population and the relationship of animals to human activities and conditions. Epidemiological investigations on large faunal samples can allow the diagnosis of otherwise unrecognizable conditions. Concerns for animal health can also be detected in tooth wear, in isotopic data for feeding and herd movement, in evidence for corrals, pens, and other protective structures, in herd demography, in the locations of settlements and water control features on the landscape, and in the ways diseased animal carcasses were disposed of. The integration of data from all these lines of evidence, and many more, can thus offer us a broader perspective on the topic of animal health in archaeology.

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ORAL PRESENTATIONS

Palaeopathological perspectives on wild animal captivity: Informing practice through understanding the past

In contemporary society, the practice of keeping wild animals in captivity elicits strong reactions. On the one hand, zoological collections fulfil an important educational and advocacy role and captive breeding programmes ensure the continued survival of some species. However, concerns over the health and welfare of captive wild animals are frequently expressed in social and traditional media, and an emergent philosophical shift is questioning anthropocentric worldviews and the 'right' of humans to exercise such control over animals. The keeping of wild animals in captivity is by no means a modern phenomenon, but there have been few systematic examinations of this practice in the past. Palaeopathology is well placed to make a meaningful contribution to this topic, since animals kept in captivity can experience health issues that are not observed in the wild, especially when diet and environment are insufficient to meet the physiological needs of the animal. In this paper we draw upon three case studies of modern and historic-period captive animals – an African elephant ("Jumbo"), a maribou stork and a lion - to develop a framework by which zoopalaeopathology can contribute to our understanding animal captivity practices in the past and provide insights that can feed back into contemporary management practices.

Keywords: *Elephant, lion, stork, captive animals,*

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Oxygen isotope time series in ancient caprine teeth from Inner Asia reveal winter occurrence of enamel hypoplasias

Harsh winters of Inner Asia impose formidable challenges on pastoralists in ensuring herd security. Management strategies must counter vulnerabilities of animals to extreme cold, deep snow packs, and graze shortages that can impede the fattening of animals prior to winter for increasing survivability. In this paper, we show that Bronze and Iron Age caprines from foothill sites in eastern Kazakhstan endured punishing physiological stress as indicated by enamel hypoplasias that frequently presented as periods of interrupted ameleogenesis to the point of exposing underlying dentine layers. Affected tooth specimens then completed mineralization, and some animals reached advanced life stages when occlusal surfaces approached enamel defects. We use incremental oxygen isotope analysis of affected tooth specimens in order to isolate the time of year during which enamel hypoplasias formed. Time series of ?18O values from enamel sampled along the growth axis of livestock teeth provide reliable records of seasonality via the oxygen isotopic composition of imbibed water, which is largely influenced by ambient temperature cycles and patterns of precipitation. We found that enamel hypoplasias in caprines exclusively formed during winter, suggesting a strong environmental burden on livestock that likely demanded careful human intervention for animals to recover from seasonal afflictions. This research provides a new method to study livestock health through high-resolution isotopic records. We further suggest that biomolecular methods should be explored in order to differentiate between nutritional deficiency and infectious agents as the ultimate cause of tooth pathologies.

Keywords: *Enamel hypoplasia, oxygen isotopes, Kazakhstan, pastoralism*

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"Of mastives and mungrels that manie we see, a number of thousands too manie there be": Trauma, abuse and population control of dogs in medieval Fosses-Saint-Ursin (Calvados, France)

Excavations of a late medieval well dated to the14th-15th centuries in Fosses-Saint-Ursin (Courseulles-sur-Mer, Calvados, France) brought to light the partial to sub-complete skeletons of over sixty dogs. Paleopathological analysis of the assemblage shows a very high prevalence of traumatic pathologies, mostly fractures, which could be the results of human-mediated violence towards a population of stray dogs. These animals may furthermore have been the later victims of one or several campaigns of stray dog eradication. This communication explores through this example several aspects of human-dog relations in the late Middle Ages, and especially the issue of dogs as pests.

Keywords: *Dogs, trauma, fracture, paleopathology, France*

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The lives and care of dogs in Coclé Chiefdoms: Insights from Tomb Apparel from Sitio Conte, Panama

The Coclé chiefdoms of late prehistoric Panama are famous for elaborate elite tombs and precious mortuary apparel and offerings. In this study, dogs from Coclé tombs are studied based on more than 1000 perforated canines, incisors, and premolars from excavations at Sitio Conte by the University of Pennsylvania Museum in 1940. This paper reconstructs the demography of the dog population, and the developmental environment and life history of individuals. The dog teeth were measured as a proxy for body size. Only one breed of dog appeared to be in question. X-rays were used to estimate the ages of the dogs. The population appeared to be very young, compared to other populations. Dental hypoplasias were examined under a digital microscope and were scored along the axis of the tooth. The flaws in the enamel of canines can be associated with severe stress experienced by puppies in the 2nd through 6th month of life. Aberrations in the roots of premolars suggest stress from infection. Wear patterns and damage on the enamel suggest other details about the diet, activity levels, and possible confinement of the dogs. The teeth were chosen as adornments and are thus a biased sample of a larger population of dogs. The dog was the only domesticated animal in this region, and represents a complicated history of husbandry and exploitation. The teeth suggest aspects of the care and social role of dogs distinct from Central American iconography, food remains, and ethnozoology.

Keywords: *Dogs, paleopathology, enamel hypoplasia, Central America*

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Poor pooch, healthy human? Dog remains from Umm el-Marra, Northern Syria

"Health" in domesticated animals is rooted in cultural conceptions of such. These are as much based upon the physical well-being of the animals, themselves, as on the roles and functions the animals play in society. Dogs played an incredibly diverse role in sacred and ritual life at the Bronze Age settlement of Umm el-Marra, northern Syria. Interment and disposal of dog and puppy skeletons indicate that they were significant, at least in death. However, evidence shows those very same animals were not treated well in life. Dog bones from the settlement show a high frequency of pathology, and evidence for human-inflicted injury – suggesting the dogs were held in disregard. How to account for this discrepancy? There is textual evidence to suggest that dogs may have been used to ameliorate health in human populations, by "receiving" human illness. Thus poor health among dogs may have signified better health in the human population. Perhaps the occurrence of both pathological and injured animals – including human-inflicted injury - in sacred or ritual contexts suggests that the "poor health" of the animals were of positive concern to the community.

Keywords: *Dogs, paleopathology, trauma, Syria, Bronze Age*

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"Whatever thing dieth, go bury or burn": Epizootic disease and the disposal of animal carcasses from Roman times to the late Modern Period

In the 1st century BC, Virgil wrote that deadly plagues fell more frequently on livestock than the storm upon the sea. This opinion appears not unsubstantiated given the many mentions of catastrophic animal murrains that strew the historical record from Roman times well into the 19th century. Research indicates that the bovine and ovine victims of these pestilences numbered in millions; animal plagues and mortalities of varying nature hit herds and flocks several times per century, and may well have had dire consequences on human societies.

It is therefore surprising that so few archaeological deposits relating to animal mortality events have yet been identified. The considerable discrepancy between archaeological and written sources led us to explore two independent but overlapping issues: the issue of the archaeological identification of mortality deposits, and that of the management of diseased carcasses by past populations.

By an interdisciplinary approach drawing on the fields of archaeology, history and veterinary science, we define simple and specific archaeological criteria for the recognition of animal mortality deposits, which we present as a diagnostic flow-chart. This tool allows us to identify in the bibliographical record a number of archaeological animal deposits probably resulting from mass mortality events. Concurrently, we explore the scarce historical evidence recording the ways in which pre-industrial societies dealt with diseased animal carcasses, and document both their perception of sanitary issues and the archaeological traces their practices may have left behind.

The two lines of research are then confronted, leading us to discuss their consistencies and discrepancies, and to reflect upon the factors affecting both the actual occurrence of animal plagues and the likelihood of their being recorded either historically or archaeologically.

Keywords: *Animal bone groups, mortality, France, epizootic disease*

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If you pay peanuts, you get monkeys: Health conditions of the non-native animals of ancient Egypt

If you paid bananas, would it be any different? Monkeys of ancient Egypt could not eat peanuts, but how come they did not eat bananas?

Monkeys of any kind were not native to ancient Egypt, however they seemed to be relatively popular among Egyptian aristocracy. Definitely, they were brought to Egypt, perhaps imported, next to other species. Several depictions show all these animals being brought. However intriguingly, only some find their way through to be depicted again, in their regular, every-day-activities. Monkeys did not have to elbow their way through the crowd, as imported animals were not that numerous. Bone records are scarce as well. Not without a reason, monkeys were the luckiest ones in iconography, which also applies to skeletal remains.

However, the latter seems to evidence against the idyllic visions of the depictions. Several reasons may be identified. In the first instance dietary issues come to light, however another, initially non-physical factor should also be taken into consideration. Moreover, in terms of the physical condition of imported animals. ancient Egyptian awareness and knowledge also deserves the attempt to be analyzed, due to the Egyptians' specificity in perception of the outside world.

Keywords: *Monkey, ancient Egypt, animal health, animal import, exotic*

animals Kamila Braulinska, University of Warsaw, ks.braulinska@uw.edu.pl

POSTER PRESENTATIONS

To be kept or not to be kept, a pork question, a zooarchaeological answer?

The feeding of swine under the guarding of a swineherd in forests is a reality informed well by the medieval iconography. But its archaeological signature is difficult to highlight because there is no structure associated with this practice. The relative abundance of the split of pig's fibula could establish a relevant indication of that, in the measure this fragile bone situated behind the shin is particularly exposed to the knocks potentially given in the legs by the swineherd to take forward animals or call back them in the rank. This poster thus explores archaeological cases by trying to see to what extent the context can allow to support this hypothesis.

Keywords: *Pigs, paleopathology, trauma, France, Medieval*

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"It's a dog's life"? Utilising pathology as part of a bioarchaeological study investigating British (post)medieval domestic dog populations, and their relationship to humans

Since their early domestication, domestic dogs have become an omnipresent species in most human societies across the globe. They act as pets, pests, and helpers; companions and possessions, resources, and disease vectors. Yet the human-dog relationship in historical time is poorly understood, archaeological research largely focusing on their prehistoric origins and specific cases of post-mortem treatment. Palaeopathological analysis of domestic dog remains, however, provides a platform for examining this unique relationship. Healed trauma can indicate activity and/or mistreatment but also subsequent care of animals. Evidence of infection may demonstrate extended care or neglect of infirm animals, while dental calculus, oral pathologies, and nutritional deficiencies can reflect animal diet.

This poster presentation explores how pathology can contribute to a wider bioarchaeological study of domestic dog populations in medieval and post-medieval Britain, developing our understanding of contemporaneous human-dog relationships. Through analysing pathologies present on (post)medieval domestic dog remains on individual and populational scales across urban, rural, ecclesiastical and elite secular sites, and integrating this with additional biographical, contextual and dietary stable isotope data, this research will explore whether the diet, health and potential subsequent care of domestic dogs varied across different social and settlement contexts and how this reflects upon the relationship between humans and dogs in (post)medieval Britain. This work will, in addition, touch upon how the full potential of pathological data can be realised when used in conjunction with other data including stable isotopes, context data, and biographical data.

Keywords: *Dogs, paleopathology, Britain, Medieval*

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Session title:

Zooarchaeology and stable isotope analysis in arid and semi-arid environments

Session abstract:

Arid and semi-arid environments impose harsh and variable conditions on human and animal populations around the world. These environments often comprise seasonal and long-term climate changes that constrain human subsistence and mobility strategies. Animal exploitation strategies have been particularly affected by these constraints, which encouraged the development of specific practices in the past, such as mass killings of wild animal populations and nomadic herding of domesticated animals, among others.

The objective of this session is to offer an occasion to discuss how stable isotope analysis carried out on archaeofaunal materials can provide new perspectives on the study of animal exploitation strategies in arid and semi-arid environments. In this sense, we aim to discuss phenomena such as the location of hunting areas, mass killings of ungulate populations, nomadic and transhumant pastoralism, seasonal foddering within herding strategies, long-distance trade of animal products, caravan trade, species biogeography and conservation biology, and climate and environmental change. These problems are currently being addressed through the analysis of different animal tissues such as bones, teeth, and -fibre all over the world. We consider that arid and semi-arid environments provide a promising scenario to explore these and other problems through stable isotope analysis because of their seasonal and spatial variability and precipitation gradients.

Hopefully, this session will encourage theoretical and methodological discussions between zooarchaeologists interested in the study of human subsistence and animal exploitation strategies in arid regions through the use of stable isotope analysis.

Organisers:

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ORAL PRESENTATIONS

Stable isotopes and animal domestication in China

The domestication of animals plays an important role in human society and human civilization. Traditionally, the biometric analysis and DNA biomarkers of animal skeletons are widely used to attribute the animal remains to be wild or domesticated. However, in recent years, the theoretical and practical developments in zooarchaeology have been favourable to understand the human-animal relationship in the human-mediated niche at archaeological records instead. North China is the original centre of millets that were suspected of human use around 11,000 years BP. This agricultural system created a new niche for humans and animals, by which both of them formed a strong bond and the animals were domesticated. In this presentation, we would like to focus on several animals such as pigs, cats and cattle by the method of stable isotope analysis (carbon and nitrogen stable isotope compositions) to reveal their dietary similarity and dissimilarity to the humans during the Neolithic Age. The aim is to provide a new perspective on animal domestication in China based on the investigation of the relationship between humans and animals in the framework of human and animal interactions.

Keywords: *Stable isotopes analysis, animal domestication, human niche reconstruction, millet agriculture, North China*

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Are the hippopotami victims of climate change in India?

The Indian Pleistocene is well known for its large mammalian abundance whose distribution across the length and breadth of the Sub-continent makes it a rich source of palaeoecological reconstruction of prehistoric India. The six-incisored hippopotamus, commonly known as hexaprotodont, is one of these large mammals whose arrival in India is dated to 4 million years. Through the passage of time, by the Late Pleistocene, it travels across India reaching Sri Lanka, where it is known as *Hexaprotodon sinhaleyus*. There are four species identified for the genus Hexaprotodon but their precise taxonomic relationship is contested. The hippo's association with water is so well ingrained that the Ancient Greek word potamos, meaning river or stream, became associated with this animal. The fossilised skeletal remains may denote the evidence of aquatic bodies, but its sudden disappearance coinciding with the LGM calls for detailed investigations, which are the focus of this paper.

The present paper deals with dental histology of this group to examine if the genus is truly a multispecies and isotope analysis to seek answers with reference to the isotopic proxies of ecology. Notwithstanding the known multispecies status of the genus, enamel ultrastructure provides little variation within the four of known species while isotopic proxies suggest some intra-specific variations attributed to the individual response to the impact of changing climatic conditions of the Terminal Pleistocene.

Keywords: *Pleistocene Hexaprotodonts, India, extinction, enamel ultrastructure, stable isotopes*

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Refinement of the nitrogen isotopic analyses of mammal herbivores in Anatolia and Levant by collagen and amino acids

To reconstruct ancient human diets and animal utilizations, nitrogen isotopic values ($\delta^{15}N$) of archaeological animal bone collagens are commonly measured. The approach is based on the isotopic discrimination that occurs during assimilation/dissimilation processes; on average, animal tissues are enriched in ^{15}N by ~3.4‰ relative to their prey. However, despite similar trophic positions, bulk collagen $\delta^{15}N$ values often exhibited significant differences by up to 3.4‰ among mammal herbivores (*Bos* sp., *Ovis* sp. and *Capra* sp.) excavated from a site, especially in semi-arid regions, *e.g.* Anatolia. To verifying the phenomenon, we measured $\delta^{15}N$ on some amino acids of herbivores from Neolithic sites in Anatolia (Hasankeyf Höyük, Aşıklı Höyük and Hakemi Use) and Levant (Tell el-Kerkh), in addition to the collagens. By the result, the trophic position estimated by the $\delta^{15}N$ values of glutamic acid and phenylalanine is consistent with that of herbivores. Because the $\delta^{15}N$ values of phenylalanine show little variation with respect to the trophic level of animals, the results indicate that these herbivores likely consumed feeds with similar $\delta^{15}N$ values. These results suggest that the $\delta^{15}N$ values of bulk bone collagen and glycine may vary among herbivores, despite fed a diet of same $\delta^{15}N$. Although specific mechanisms controlling the $\delta^{15}N$ values of glycine from animals are unclear, the difference of metabolism response to arid conditions may be one of the reasons for the variation of bulk collagen. The differences in the $\delta^{15}N$ values of bulk collagen and the ^{15}N-enrichment factors among mammal herbivores is possible to be useful as potential tracers for human diets and animal utilizations.

Keywords: *Nitrogen isotopes, amino acids, collagen, mammal herbivore, interspecies differences*

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Preliminary report on the stable isotopes study for the paleomammal fauna from Rancho Córdova, San Luis Potosí, México

In northern San Luis Potosi State, central Mexico, nearby the small town of Cedral, there are two important archaeological-paleontological localities, Rancho La Amapola, and Rancho Córdova. The first one was studied in early 1980's and there was evidence of possible early human activity, but also a diverse Late Pleistocene terrestrial vertebrate fauna, including reptiles, birds, and mainly mammals. On the other hand, Rancho Córdova was recently discovered and initial excavations were undertaken, with important findings for horses *Equus cedralensis*, camel *Camelops hesternus*, and Columbian mammoth *Mammuthus columbi*, species also known from Rancho La Amapola. Radiocarbon datings are warranted in order to probe if both localities were contemporaneous since they are very close one to the other. However, based on the stable isotopes assays for specimens from both localities, it seems that the large mammals were living in similar environments since those resulted in similar isotopic values for carbon and oxygen on dental samples for horse, camel, and mammoth from both localities. The results show that horses used to eat C_4 plants and live in an open habitat, while camels had a mixed C_3/C_4 diet and lived in a slightly forested habitat, similar to the mammoths. Overall the three animal species from both localities lived on a grassland with a nearby forest, which eventually was also the home for the first humans in México.

Keywords: *Stable isotopes, Rancho Cordova, Late Pleistocene, herbivorous*

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Carbon and nitrogen stable isotope compositions of South American camelids in the South-Central Andes: Towards a frame of reference at the supra-regional scale

With the aim of contributing to the development of an isotopic ecology in the South-Central Andes which could be applied to different archaeological contexts, we present a large-scale comparison of carbon and nitrogen stable isotope compositions measured on bone collagen from modern South American camelids. Samples come from the Dry and the Salt Puna of Northwestern Argentina along the Atlantic side of the Andes, totalling 181 cases. Half of these belong to wild camelids –that is *Vicugna vicugna*– and half to domestic camelids –that is *Lama glama*. They come from diverse settings at altitudes ranging from 3300 to 4700 m a.s.l. Camelid samples display $\delta\ ^{13}C$ values averaging –18.8 ‰, ranging from –23.5 ‰ to –13.8 ‰, while $\delta\ ^{15}N$ values present a median of +5.9 ‰, ranging from +1.5 ‰ to +11.3 ‰. We discuss the distribution of these stable isotope compositions as regards animal variables such as taxon and age, environmental and geographic variables relative to altitude and latitude, and the productive system in the case of domestic camelids. We also compare these patterns to those known for the Central Andes and adjacent areas. The results presented here will allow us to discuss the Puna ecosystem in terms of its isotopic ecology and hopefully in future outcomes will prove useful for the study of herding and hunting strategies employed by the human groups that occupied this area in the past.

Keywords: *Carbon stable isotopes, nitrogen stable isotopes, Argentine Puna, Camelidae*

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Discussion: Zooarchaeology and stable isotope analysis in arid and semi-arid environments

The objective of this session is to offer an occasion to discuss how stable isotope analysis carried out on different archaeofaunal materials can provide new perspectives to the study of animal exploitation strategies in arid and semi-arid environments. These environments impose harsh and variable conditions on human and animal populations around the world, which especially constrain human subsistence and mobility strategies.

In this discussion we will comment some of the most relevant contributions of stable isotopes analysis within zooarchaeological research in arid and semi-arid zones. We will emphasize the theoretical and methodological aspects that will be addressed during this thematic session. The session will include several presentations covering a wide spatial range worldwide, with papers from China, India, the Middle East, Mexico, Chile, and Argentina. This implies a great diversity of analysed species, such as cattle, pigs, turtles, hippos, horses, and camelids, as well as problems that are being addressed, such as: animal and vegetal domestication, hunter-gatherers subsistence strategies, environmental changes, isotopic ecology, and isotopic discrimination, among others.

Hopefully, this session will encourage theoretical and methodological discussions between zooarchaeologists interested in the study of human subsistence and animal exploitation strategies in arid regions through the use of stable isotope analysis.

Keywords: *Arid and semiarid environments, stable isotopes, archaeofaunal materials*

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POSTER PRESENTATIONS

Camelid domestication in the Atacama highlands: The contribution of stable isotopes in the Tulan and Puripica ravines (Antofagasta Region, Chile)

The results of stable isotope analysis of $\delta^{13}C$ and $\delta^{15}N$ in collagen and $\delta^{18}O$ in bioapatite are presented, carried out on the remains of *Vicugna vicugna*, *Lama guanicoe* and *Lama glama* from various sites of the Puripica and Tulán ravines of the Puna de Atacama (Chile), within a sequence that spans from Early Archaic to Early Formative. These analysis were developed in order to fulfil several objectives:
(1) to correlate the osteometric data with the isotopic values of wild and domesticated camelids of both ravines, (2) to identify the differences and altitudinal similarities of the isotopic values of the plants from data of current studies in the zone, (3) to differentiate the stable isotope values in the size groups of camelids related to domesticated animals that suggest differences with *Lama guanicoe* and *Vicugna vicugna*, among other objectives. For this, the analyses were carried out in 82 samples (CAIS, University of Georgia). The archaeofaunistic samples were selected using osteometric criteria. The results indicate for the isotopic values of the Early and Middle Archaic (10,000-5,500 years AP), changes associated with the environmental transformations registered for the Puna de Atacama. By the beginning of the domestication process, during the Late Archaic (5,300-4,000 BP years), a breeding is observed in the flats of ravines and oases within a grazing that can be defined as sedentary, which is maintained during the Tarajne Phase (3,700-3,200 years BP), while in the Early Formative (3,100-2,400 BP years), there is an expansion of foraging areas for domestic camelids associated to practices consolidated in the management of these animals within transhumant pastoral movements.

Keywords: *Camelids, stable isotopes, domestication, Atacama Desert, Chile*

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The role of carbon and nitrogen stable isotopes for understanding the dynamics of hunter-gatherer populations in Southern Patagonia during late Holocene

In southern Patagonia modifications in the organizational systems of hunter-gatherers in relation to changing climatic conditions during the final late Holocene had been proposed. These have involved rearrangements and regional differentiation of human populations. Therefore, this study proposes how $\delta\ ^{13}C$ and $\delta\ ^{15}N$ in zooarchaeological remains can contribute to this discussion on the dynamics of hunter-gatherer populations. The specific aim of this study is the analysis of $\delta\ ^{13}C$ and $\delta\ ^{15}N$ variability in herbivores along a longitudinal transect in southern Patagonia, in a latitudinal strip from the Atlantic Ocean to the Andes mountain range between 47º and 49º south latitude. The greatest concentration of mortuary contexts for southern Patagonia has been recovered within this spatial range. These come from the same type of mortuary context locally known as *chenque*, assigned to the final late Holocene. This study seeks to establish the frame of reference for performing mobility and paleodietary interpretations of the human remains recovered along this transect. Thus, it is discussed the implications of these results for the study of the dynamics of hunter-gatherer populations in southern Patagonia during the last 1,000 years.

Keywords: *Carbon stable isotopes, nitrogen stable isotopes, herbivorous*

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Session title:

Shells of molluscs as archaeological and environmental records

Session abstract:

Since the publication of the first papers dedicated to molluscs in the early 1970s, archaeomalacology has raised the interest of an increased number of specialists, archaeologists, and historians. The objective of this proposed session at the ICAZ conference in Ankara is to bring together researchers studying shells of molluscs, but also crustaceans and echinoderms, and to facilitate discussions. This session should be very inclusive, to highlight the diversity of methods and approaches within the time periods, from Pleistocene to modern times, and in very diverse socio-cultural contexts. We also welcome papers from both marine and non-marine environments.

This session will therefore focus on a broad range of topics: discussing the specificities of littoral settlements and exchange networks, the changes in customs and cultures (diet, ornaments...), the impacts of human activities and/or their adaptations to the environment.

Organiser:

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ORAL PRESENTATIONS

Is one shell enough? Isotope study of recent mollusc shells and its application in palaeoenvironmental reconstructions

Carbon (^{13}C) and oxygen (^{18}O) stable isotope values of lacustrine sediments are among the standard proxies applied in palaeoenvironmental studies. However, this method is not limited to strictly climatological reconstructions but is also frequently used in archaeological studies. In the present paper the stable isotope composition of recent gastropod shells, primarily, the species commonly preserved in European Quaternary lacustrine sediments is presented. All molluscs were sampled life from several sites in Lake Lednica, western Poland. Shell ^{13}C values were species-specific and among the gastropods studied the same order of species from the most to the least ^{13}C-depleted was observed at all sites sampled. Shell ^{18}O values were more uniform. The wide range of ^{13}C and ^{18}O values were observed in population and subpopulation, i.e. when gastropods were sampled live from the restricted area within the lake littoral zone. Such significant variability in ^{13}C and ^{18}O values indicates that stable isotope composition of single shells is unlikely to be representative for the isotope composition of water and DIC the shell grew in. This applies particularly to species associated with macrophytes. Even greater variability is observed in mono-specific subfossil shells when 1 cm thick sediment sample covers several to several dozen years. Those intra-specific differences (n=20) were as large as several permill. In conclusion, samples of freshwater molluscs for stable isotope analyses should be monospecific and composed of at least several shells. The number of shells being dependant on the difference between the minimum and maximum values within the sediment layer.

Keywords: *Mollusc shells, palaeoenvironment, stable C and O isotopes, number of shells* Karina

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Archaeomalacological evidence of the site formation processes in the Central Europe

Land snails have been conventionally used in archaeology for environmental reconstruction and study of human impact (in Europe e.g. Evans 1972, Lozek 1981, 1998), but more rarely are used to investigate site formation processes to differentiate cultural and natural processes (e.g. Peacock et al. 2005). The most of terrestrial snails grow to millimetre size and live in landscape unnoticed by human. Land snails occur often in numerous specimens and species, indicate on-site conditions and refer to site formation processes. In this paper, I compare and combine malacozoological evidence with archaeological material and results of micromorphology, geochemistry, archaeobotany and zooarchaeology. I systematically evaluate the Central European archaeological features of different purposes (storage pits, houses, post-holes, graves, ditches) and periods (since Neolithic up to Early Medieval Period). The paper reveals the patterns, which subfossil shells create and interprets them in terms of duration and type of deposition processes according to Schiffer´s behavioural archaeology (1972, 1976, 1987).

References:

Evans, J. G. (1972). Land Snails in Archaeology. London – New York.

Lozek, V. (1981). Mekkyši v archeologii. Archeologické rozhledy, XXXIII, p. 166–175.

Keywords: *Land snails, behavioural archaeology, site formation processes, Central Europe*

Lozek, V. (1998). Pozustatky fauny v archeologickych vykopech a jejich vypoved. Část I – Základní údaje a mekkyši. Archeologické rozhledy, L(2), p. 436–445.

Peacock, E., Rafferty, J., Homes Hogue, S. (2005): Land snails, artifacts and faunal remains: understanding site formation processes at Prehistoric/Protohistoric sites in the Southeastern United States. In Bar- Yosef Mayer (Ed.) Archaeolomalacology: Molluscs in former environments of human behaviour, Proceedings of the 9th Conference of the International Council of Archaeozoology, Durham, August 2002, Oxbow books, p. 6-17.

Schiffer, M. B. (1976). Behavioural Archaeology. New York - San Francisco - London: Academic Press.

Schiffer, M. B. (1983). Toward the Identification of Formation Processes. American Antiquity, Vol. 48, No. 4, p. 675-706.

Schiffer, M. B. (1987). Formation Processes of the Archaeological Record. Alberque: University of New Mexico Press.

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An aquatic palaeoecology study on Plio-Pleistocene marine mollusc assemblages of Sangiran Dome, Central Java, Indonesia

Palaeoenvironments are interpreted from the taphonomy of mollusc assemblages of Kalibeng layer in Sangiran dome. Sangiran dome, the early man site, is the principal locus for the Plio-Pleistocene deposits of the Solo Basin of Central Java. The Kalibeng layer is the base stratigraphic sequence of the dome, composed of volcanic materials namely, the bluish gray clay with Balanus limestone and Turritella beds from 2.6 Ma. Molluscs are deposited in the upper part of the Puren layer. Three liters of bulk samples was taken from each of the seven sites belonging to the Kalibeng deposits. From the samples, 21 bivalves and 21 gastropods were identified. All belongs to full marine environment, mostly in soft bottom sublittoral zone. The study shows that species richness and distribution patterns of the most common mollusc species are closely related to the stratigraphic sequence with combination of ecological, environmental and taphonomic processes of Plio-Pleistocene deposits in Sangiran. The dominance of taxon from family Arcidae (Anadara sp., Arca sp. and Arcopsis sp.) and genus Turritella (Turritellidae) suggests the development of shallow water body in central Java of the Sunda arc around 2 million yeas ago.

Keywords: *Plio-Pleistocene, molluscs, aquatic palaeoecology, Sangiran, Java Island*

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Paleoenvironment and paleoseasonality at Çatalhöyük revealed from mollusc shells

At the Neolithic site of Çatalhöyük, Turkey, thousands of shells were collected and studied. About one thousand were used as ornaments, but several thousand more were small molluscs ranging in size from a few millimeters to a few centimeters that inhabit various water bodies around the site. Those were mostly brought into the site along with the mud for the formation of mud bricks. Their study enabled us to identify different types of water bodies around the site including rivers and marshes. Because the inhabitants of the site also collected relatively large Unio shells as a food source, we were also able to conduct an isotopic study. This indicated that shellfish were collected in the fall. The study contributes to understanding the seasonality pattern during the Neolithic period in Anatolia and to the overall reconstruction of environmental conditions when Çatalhöyük was inhabited.

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Archaeomalacology at Neolithic Çatalhöyük (Konya Plain, Turkey): Results from the 2009-2017 excavations

Archaeological research at Çatalhöyük since 1993 brought to light a rich archaeomalacological assemblage that offered insights into several mollusc- and shell-related subjects (e.g., Reese 2005; Bar-Yosef Mayer 2013; Gümüş & Bar-Yosef-Mayer 2013). This paper discusses the results from the study of the shell material recovered during the 2009-2017 excavations with the aim to explore the patterns of mollusc and shell consumption, by shifting the emphasis into the different contexts of deposition to allow a contextualised approach across time and space. The material comprises three distinctive shell groups: freshwater mussels consumed as food and secondarily used as raw material; freshwater gastropods brought to site along other materials (sand, plants) from the nearby water-bodies; recent and fossil marine shells from distant areas manufactured into artefacts. Therefore, the rich variety and abundance of shell material, coupled with the results from stable isotope analysis, allows discussing a large spectrum of on- and off-site human acts, including the seasonality of the exploitation of natural resources, food consumption and maintenance practices, communication networks, craft technologies and body decoration. The distribution of the material suggests continuities and discontinuities in patterns of consumption across time and space that are investigated in the context of both natural and cultural changes.

References:

Bar-Yosef Mayer, D.E. (2013). Mollusc Exploitation at Çatalhöyük. In I. Hodder (ed.), Humans and Landscapes of Çatalhöyük: Reports from the 2000-2008 Seasons. Los Angeles: Cotsen Institute of Archaeology Press, pp. 329-338.

Gümüş, B.A. & D.E. Bar-Yosef Mayer (2013). Micro-freshwater Gastropods at Çatalhöyük as Environmental Indicators. In I. Hodder (ed.), Humans and Landscapes of Çatalhöyük: Reports from the 2000-2008 Seasons. Los Angeles: Cotsen Institute of Archaeology Press, pp. 81-86.

Reese, D. (2005). The Çatalhöyük Shells. In Hodder I. (ed.), Inhabiting Çatalhöyük: Reports from the 1995–99 Seasons. London: British Institute at Ankara, pp. 123-128.

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A string of marine shell beads from the Neolithic site of Vršnik (Ovce polje, Republic of Macedonia)

Beads made of Spondylus gaederopus, Antalis vulgaris and Cyclope neritea, most likely forming a single string, are found in an anthropomorphic vessel at the Neolithic site of Vršnik (Ovce polje, Republic of Macedonia). The discovery was made in the course of the excavations of the Neolithic settlement, conducted by Milutin and Draga Garašanin (1961). In the excavation report, the anthropomorphic vessel has been illustrated, and the find of shell beads just shortly mentioned. Later, this find has been forgotten and omitted on the maps of Spondylus/marine shells findings in the prehistoric Europe.

Majority of beads are made of Spondylus and Antalis shells. Being that these two molluscs have shells of very different morphology and structure, beads are unexpectedly similar in size, shape and color. Assumption is imposed that exactly that was the intention of the beads' producer, to make the like out of unlike row material.

The use of Cyclope shells on one side, and Spondylus beads on the other, point to interweaving of Mesolithic tradition and adoption of new, Neolithic trends in ornament production and exchange. At any rate, this find represents an important datum for the European Spondylus exchange network in the Neolithic period. Also, it adds to the appreciation of Antalis items' share in the exchange network, which might be underestimated because of the difficulties of scaphopod identification. Putting this find back in focus is also a motive to undertake mapping of items made of marine shells, in Pelagonia, the valley of the river Vardar and Ovce polje in Macedonia, the region previously poorly researched in this respect.

Keywords: *Spondylus, beads, Neolithic, Vršnik, Macedonia*

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Shell ornaments distributional patterns in the Aegean and Eastern Mediterranean Bronze Age as indicators of identity and connectivity

Shell ornaments have a special importance in the studies about prehistoric cultural identities. The mollusc species that were utilized, as well as the shapes in which their shells were worked, often expressed symbolisms and semiotic meanings that were interpretable only in a specific culture. The result is that peculiar shell ornaments are characteristic of defined periods and regions. The study of their chronological and geographic distribution may contribute either to define ancient cultural identities and their dynamics or to identify the cultural connections among them. The archaeomalacological data about the Aegean and the Levant of III and II millennium BC are particularly suitable for such kind of analytical approach. The distributional pattern analysis of several types of shell ornaments from Greek, Turkish, Cypriot, Near Eastern and Egyptian Bronze Age sites revealed how these items were strongly related to regional traditions. Their discovery in archaeological contexts away from the traditional geographic area suggests sometimes the sporadic presence of foreigners in a site or, otherwise, the diffusion of a tradition from one area to another with important implications about the expansion of cultures as well as about possible migrations phenomena.

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Shells at death – The use of shells in Neolithic mortuary contexts

Shells constituted a cultural resource for human groups throughout history. As such, they were used and incorporated in different aspects of life – and also death. In this study we examine the use of shells in mortuary contexts, focusing on the Neolithic site of Kfar HaHoresh, and other contemporary sites in the Mediterranean zone of the southern Levant.

Kfar HaHoresh is a Pre-Pottery Neolithic B (PPNB) cultic/mortuary site in the lower Galilee. Architectural elements, material culture and mortuary practices change through the Early, Middle and Late PPNB sequence found at the site, reflecting changing cultural behaviors, norms and beliefs.

Approximately 70 marine shells and 50 freshwater shells were found in burial contexts at Kfar HaHoresh, dated mainly to the Late and Middle phases. The entire mortuary marine shell assemblage is of Mediterranean origin, dominated by bivalves. Cerastoderma glaucum is the most abundant, followed by Acanthocardia tuberculata and Glycymeris species. Few of the marine shells were intentionally manipulated – perforated, abraded, grooved, etc. All but two of the freshwater shells are Melanopsis buccinoidea. Most of the Melanopsis shells were found as caches associated with specific burials.

These and other trends, including the choice of taxa, intentional shaping and manipulation of the shell, as well as possible use traces, are examined in this study. They are compared between burial types, PPNB phases on-site, and other sites, in order to trace different aspects of the cultural use of shells, as part of evolving Neolithic mortuary practices.

Keywords: *Shell, burial, grave-goods, Neolithic, PPNB, Kfar HaHoresh*

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Neolithic exchange networks of marine shell ornaments in the East Jordan desert area

Neolithic Settlements in the South Levant have yielded a certain amount of marine shell ornaments from both the Mediterranean and the Red Sea. It is therefore assumed that bidirectional exchange had been conducted in the South Jordan. This study reveals that an exchange network also existed in the East Jordan desert area. In order to examine this issue, marine shell ornaments unearthed from the desert area sites, Wadi Abu Tulayha and Abu Nukhayla in the East Jordan, and Wadi Sharma 1 in the Northwest Saudi Arabia, will be analyzed biologically, technologically, and typologically. These Neolithic sites are dated from the Middle Pre-Pottery Neolithic B (hereafter PPNB) to Late PPNB. Twenty or more marine shell ornaments were unearthed from Wadi Abu Tulayha. In contrast to Abu Nukhayla and Wadi Sharma 1, the total number is small, and most specimens were brought from the Red Sea. However, two Nasa gibbosulus specimens that can be definitely identified with the Mediterranean shell were unearthed from Wadi Abu Tulayha. Additionally, Cowry, Nerite, and Nasa mud snail shell ornaments unearthed from Wadi Abu Tulayha, Abu Nukhayla, and Wadi Sharma 1 are found to be similar typologically. Therefore, it can be considered that bidirectional exchange had been conducted at Wadi Abu Tulayha in the East Jordan desert area. Although Wadi Abu Tulayha has been considered to advance to the East Jordan desert area, the Neolithic settlement may have played the role of the exchange network of marine shell ornaments in the South Levant.

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Shrimp remains (*Crustacea decapoda*) in the Roman harbour of Ratiatum (Rezé, Loire Atlantique, France): Species identification and biometry

Numerous shrimp remains (*Crustacea decapoda*) were identified in roman levels (1st - 3rd century A.D.) of the harbour area of Ratiatum (Rezé, Loire-Atlantique, France). Rarely identified in archaeological assemblages, their presence here is linked to wet-environment preservation and to the careful sieving of the samples with a 1.1 mm square mesh.

Remains of marine or freshwater shrimp can be identified to genus or species level, which allows the determination of their origin and of their life environment. To facilitate this identification, we elaborated dichotomous keys based on published biological research. These keys allow the specific determination of shrimp and rely on the identification of morphological criteria on easily-determined skeletal parts such as the rostrum and the telson. They take into account all families frequently encountered in current natural environments.

In Ratiatum, two species were identified: *Palaemon longirostris* (over 100 individuals, based on rostral morphology), and the sand shrimp *Crangon crangon* (less than 10 individuals, based on telson morphology).

In addition, we try to establish biometrical relations (relation between total length and inter-tooth distance under the rostrum), through the measurement of current-day shrimps, to help us to reconstitute the original lengths of the shrimps of Ratiatum.

Keywords: *Marine shrimps, freshwater shrimps, crustaceans, sieving, biometry*

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Exploitation of molluscs in Alexandria (Egypt) during the Antiquity: An overview of usages

The exploitation of mollusc resources around Alexandria (Lower Egypt) is attested from the creation of the city at the end of the fourth century BC by the presence of shells in all urban archaeological sites.

Marine, freshwater and terrestrial molluscs were fished in surroundings of the city, located between the Mediterranean Sea, the region of Mareotis Lake, and few kilometers from the Nile. The malacofauna from these different environments is specific and diversified.

A corpus of 2000 fragments of shells, crustaceans and echinoderms, collected by hand during seven rescue archaeological excavations in the Egyptian city, have been established. These shells come from several dwellings belonged of different social categories of the society who lived in the city.

This paper proposes an overview of the exploitation of mollusc resources by different populations in Alexandria throughout Antiquity, from Hellenistic to Roman periods, between the fourth century BC and the sixth century AD.

Several aspects will be highlighted including food diet and consumption choices, fishing strategies, but also craft activities involving shells. We will mention their use for ornamentation in dwellings with some evidence. Finally, with a diachronic approach, we will discuss on cultural and social evolutions of customs of inhabitants during the Antiquity.

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The exploitation of marine invertebrates along the French Atlantic coast during the Middle Ages and the Early Modern period

Although the archaeozoological studies on French medieval archaeological sites have become more frequent, malacofauna is still too rarely taken into account. Besides, medieval and modern written sources are very little loquacious about shells: marine invertebrates are quite rare in culinary books or in medieval/modern accounts. Yet the inventory of dumps and their components certifies that medieval populations have eaten and used these marine resources, sometimes on a large scale.

This paper aims to present the main results of a PhD thesis conducted at the University of Rennes 2 (France) and which should be defended at the end of the year. This work has combined the results of several archaeomalacological studies and the systematic analysis of excavation reports in the studied area (from the Channel to the Garonne estuary). Several questions will be addressed, mostly concerning the medieval diet: the choice of species, the influence of social status, the relationships with the seashore, the gathering territories, the regional customs and the culinary habits. The archaeomalacological data will be confronted to the few pieces of information that could be obtained from written sources. Aside from the food use of marine invertebrates, we will also discuss the other uses that were made of seashells during the Middle Ages, and specifically the use of shells as building materials through two examples mostly: the abbey of Landévennec and the castle of Suscinio (Brittany, France).

Keywords: *Malacofauna, medieval and modern diet, building material, French Atlantic coast*

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International and long-distance trade of fresh mollusks and shells: A view from the Byzantine Negev

The Byzantine project questions the factors leading a society located in a marginal region, the Negev Desert, to flourish during the 5^{th}-6^{th} century CE and the causes for its decline during the 7^{th} century. The project focuses on retrieving data from archaeological contexts such as households,agricultural installations and trash mounds. The retrieved shell assemblages from the various excavated contexts originated at the sites of Shivta, Nitzana and Elusa show some differences in terms of species distribution that might reflect changes in the infra-structure and international trade which allowed export of goods over long distances. The shell assemblage from the city of Elusa is dominated by *Donax trunculus*, a small and edible clam, found in the sand on exposed beaches, both in the east and west Mediterranean. Other Mediterranean edible species found are *Mytylus galloprovincialis* and *Ostrea sp.* The import of fresh/pickled clams for consumption (>30 kms from the sea) testify to the commercial networks. Mediterranean mollusks were also found in Nitzana and Shivta. In addition, the finding of shells from the Red Sea (>300 kms) and the Nile River (>200 kms) in Elusa indicate the Byzantine Negev sites are located along the main ancient trade routes which connected the Red Sea with the Mediterranean Sea and Egypt. The mollusks assemblages from the Byzantine Negev provide important insights to the international and long distance trade of both fresh and edible products and shells from various aquatic resources.

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Cowrie shell modification practices: experimental archaeology and microscopic analysis

Cowrie shells *Monetaria moneta* and *Monetaria annulus* are widespread in the archaeological record of West and East Africa. Oftentimes these shells have been perforated or had their dorsa (the domed part of the shell) removed. A modification thought to have been conducted to facilitate stringing. While some studies have suggested this could have been achieved through slicing or grinding, comparative few technical studies have been conducted to explore the exact process of modification in the region or to examine how anthropogenically modified shells differ from those damaged by natural processes.

These questions have been examined in greater detail as part of the Leverhulme funded Cowrie Shells: An Earl Global Commodity Project (PI Professor Anne Haour). This paper presents the outcomes of microscopic analysis and experimental archaeology conducted as part of this project.

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POSTER PRESENTATIONS

Application of carbon (^{13}C) and oxygen (^{18}O) stable isotope analysis to determine the origin of shells used to produce ornaments from Neolithic burial sites in Central Poland

Neolithic burials rich in ornaments, so-called "princesses' burials", were excavated in the Kujavia Lowland, central Poland. Beads used to produce the ornaments were made from the shells of freshwater genus Unio. We made an attempt to determine the origin of the shells used to produce the ornaments using carbon and oxygen stable isotope compositions (?13C and ?18O) of the beads. We decided to test this method and its potential application in archaeological studies. The results allowed to distinguish between two major sources of shells, riverine and lacustrine. Shells derived from rivers were characterized by low ?13C and ?18O values, whereas shells from lakes were 13C and 18O-enriched. Isotope values in beads were specific to each burial and suggest that the shells used in bead production used to make one ornament were derived from one, riverine or lacustrine source. On the contrary, significant differences in beads isotope values were noted between burials.

Keywords: *Neolithic ornaments, origin of beads, freshwater mollusc shells, stable C and O isotopes*

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Evidence of crayfish in several Medieval and Post-medieval sites in the East of France

Crayfish remains were identified among the animal remains of four archaeological sites located in the East of France. They were exclusively discovered in medieval and post-medieval latrines, this type of context probably allowing their conservation. They are usually highly fragmented and are mostly represented by only a few fragments of carapace and claws. Despite this scarcity, these regular discoveries suggest that crayfish were very regularly eaten.

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Investigating the size of aquatic catchments through the reconstruction of freshwater mussel habitats in Mississippi and Alabama, USA

Throughout the settlement of the American Southeast, prehistoric communities appear to have augmented food supplies by intensifying their exploitation of the environment. This intensification seems likely to be a response to increasing population pressures. Over time, the range of species used for food began to include larger amounts of calorically lesser ranked resources, such as freshwater mussels. These mussel remains provide a valuable source of information about past environments. Because many mussel species are extremely sensitive to the characteristics of the waterways in which they live, the pattern of species distribution and densities potentially enable one to reconstruct the nature of past waterways. Here, I use assemblages of mussel shell from the Tombigbee River Basin, Mississippi and Alabama, USA to construct hypothetical aquatic catchments that were used by prehistoric populations. These are established using a spreadsheet-based program called UNIO, which produces the most likely aquatic habitat given the species present, and weights the calculated habitat according to the abundance of species present. Comparing catchments drawn from Late Archaic Period (ca. 2000-1000 BCE) and the Late Woodland Period (ca. 600-1200 CE), it is possible to show range constriction over time, which can then be linked to decreased mobility, indicating increased population pressure.

Keywords: *Environmental reconstruction, archaeomalacology, Southeastern United States, freshwater catchments*

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Shades beyond purple: Examining other uses of molluscs in the Iron Age Levant

Since the Bronze Age, urban centers in the Levant were extracting purple dye from shellfish of the Muricidae family (especially Hexaplex trunculus, Murex brandaris, and Thais haemastoma). Given the prominence of the purple dye industry, particularly into the Iron Age, archaeological research on marine resource exploitation in this region has concentrated on identifying production sites, while overlooking the appearance of shells of numerous other molluscan taxa recovered from cultural deposits. As a result, we are left with an incomplete picture of how coastal communities engaged with the marine environment in the past.

Focusing on Iron Age contexts from Levantine coastal sites, I examine the shell evidence for the harvesting and trade of various molluscan taxa as food, votive offerings, ornaments, and raw material for decorative inlays. Particular examples include evidence for the consumption of Ostrea edulis (oysters) and Patella sp. (limpets), among other species; ritual deposits of triton and cowrie shells; and the import of engraved Tridacna and Lambis shells. I also address the need to distinguish water-borne deposition from archaeological deposition of shell remains in coastal sites.

Keywords: *Shells, shellfish, marine resource use*

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How to conserve an artifact which is made of Pecten Jacobaeus's shells

Pecten jacobaeus is one of the Mediterranean scallops and a marine bivalve mollusk and an eatable saltwater clam which is the belong the family *Pectinidae*, It is also known by Christians as St. James' scallop.

The artifact was found together a significant quantity of ancient glass finds in a rescue excavation in the Bandırma district of Bursa, Turkey. It has two holes in the left and right side and rings in these holes. There is also an attachment on the flat surface as a handle. According to visual examinationation, the artifact was probably used as a jewelry box or a makeup box.

Before any treatment on this artifact, portable X-Ray Fluorescence Spectroscopy, Raman spectroscopy and X- Ray Diffraction have been used to evaluate the conservation state of this artifact.

In this presentation, the aim is to show that the stages of conservation of an artifact which is made of *Pecten Jacobaeus*'s shells and the collaboration of between conservators, archaeologists and scientists.

Keywords: *Conservation, Pecten Jacobaeus, archaeological science*

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Onycha production and marine resources exploitation on the Red Sea Coasts from Hellenistic times to Late Antiquity: New archaeomalacological data from Berenike (Egypt), Adulis and Galala (Eritrea)

Recent archaeological excavations in the important Red Sea sites of Berenike (Egypt), Adulis (Eritrea) and Galala (site near Adulis considered one of the main landing places serving the city in antiquity) revealed large amounts of marine archaeozoological remains whose analysis allowed to understand the economic and cultural role of marine resources for the local communities.

Marine organisms provided an important contribution to the diet as well as shells for utensils, vessels, incense burners, ornaments and raw materials as mother-of-pearl, shell and tortoiseshell.

Taphonomical analyses on the archaeozoological finds contributed also to define the food processing in the sites and the ecology of local communities as parts of the ancient ecosystems.

An archaeomalacological deposit in Galala and special finds in Berenike strongly suggest an interest focused on gastropod opercula in both the sites. The association of opercula and incense burners in Berenike attest their use from Hellenistic times to Late Antiquity as incense ingredient.

Considering the dubious nature of the ancient onycha ingredient of the “holy incense” we consider this the first archaeological attestation of its marine origin.

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