

## SESSION ABSTRACTS

### AGEING AND SEXING

Organiser: Deborah Ruscillo

The full-day Ageing and Sexing (A & S) Colloquium at ICAZ 2002 is organized with a few objectives in mind. Firstly, the session seeks to provide a forum where new methods aiding in the classification of age and sex from animal remains can be introduced. Secondly, ICAZ provides a unique opportunity to present techniques to a peer group of zooarchaeologists so that discussions and comments can improve new methods before going to press. Thirdly, the A & S session offers a chance for presenters to demonstrate their methods and results in a practical hands-on manner to their peers. Finally, the ensuing monograph will provide a source book of some of the latest techniques in ageing and sexing animal bones and teeth. Major themes of the session include the expansion of pre-existing methods of ageing and sexing, the introduction of alternative methods of ageing and sexing, the implementation of chemical and molecular studies in the classification of sex and age, new allometric data for various species, innovative dental attrition studies in ungulates, the affects of castration on the mammal skeleton, and methods applicable to fish and bird remains. A comparison of techniques and the pros and cons of each method will be addressed in the discussion periods. Cordial dialogue will aid in the communal goal of addressing interpretive problems of results presented, and fine-tuning new and pre-existing ageing and sexing methods. Papers addressing ageing techniques will occupy the morning section of the session, while sexing techniques will be presented in the afternoon section of the colloquium.

### MILK, MILKING AND DAIRYING

Organiser: Jacqui Mulville

The use of animals for live products such as milk, blood, wool and traction was a revolution in the human-animal relationship. To understand this revolution, and the subsequent effect this had on human society, archaeologists have endeavoured to identify and characterise the inception and nature of 'secondary products' usage. The first attempts to identify milking were made on the basis of textual (Killen 1964) and zooarchaeological evidence (Payne 1973 and Legge 1971). Since this time many other strands of evidence have been employed to recognise milk production in the archaeological record - for example: iconographic representation, ethnographic and historical data, production models, changes in animal physiology and residue analysis.

This session brings together the diverse archaeological community that is currently engaged in this area of research. In identifying milk usage we are seeking to answer a number of questions: when was milk first used, when did milking become common, when and how did specialised dairy economies develop? This session will re-asses how effective the methods we employ are in addressing these issues in the light of recent developments and debates. For example, how good are production models, should we continue to use them? Are there changes in animal physiology that we can use as markers for milking? Can we identify milk on pots, and what does this tell us? How can historical or ethnographic practices inform our understanding of milking and the use of milk?

Killen, J., 1964, The wool industry of Crete in the Late Bronze Age. *Annual of the British School at Athens* 59: 1-15

Payne, S. 1973 Kill-off patterns in sheep and goats. *Anatolian Studies* 23: 281-303.

Legge A.J. 1981 The agricultural economy. In R. Mercer (ed.) *Grimes Graves Excavations 1971-72*. London, H.M.S.O. pp. 79-103.

## **DOGS AND PEOPLE IN SOCIAL, WORKING, ECONOMIC OR SYMBOLIC INTERACTION**

Organiser : Lynn Snyder

The association of humans and canids is one of our most ancient and mutualistic relationships. This session explores the complex and continuing interaction between humans and dogs, in its many forms. The ancient, historic, and contemporary contexts of the human-canid association, within which our own relationship with dogs - as well as our research - is conducted, will also be explored.

## **NEW METHODS AND THE FIRST STEPS OF MAMMAL DOMESTICATION**

Organisers : Jean-Denis Vigne, Daniel Helmer & Joris Peters

Analysing and understanding the first steps of the domestication of mammals, including the prehistoric spread of the domestics, is one of the main contributions of archaeozoology to the history of man and of the societies. This explains why this topic has historically been one of the most attractive (and debated too) in ICAZ Conferences. Though archaeozoology has considerably widened its fields of investigation, researches in first domestication remain today very dynamic.

During recent years, a lot of new data appear in new areas such as China, South-West Asia, Africa, as well as in the more traditional areas of America and the Near and Middle East. These progress results of course from the widening of archaeological thought throughout the world, but also from new methodological approaches.

This session will focus on this methodological evolution in order to evaluate the relevance and limits of the different approaches, and finally to take stock on the role that archaeozoology may play in the future in the general anthropological debate on the birth of domestication.

Progress partly took advantage from new techniques such as molecular analysis of the present day diversity of domestic mammals, fossil DNA analysis of prehistoric bone or teeth, new osteometrical analysis which allows to distinguish shape from size, stable isotope analysis... Papers illustrating both potentialities and limits of these methods will be welcomed. However, improvements of more traditional osteo-archaeological techniques are also able to bring important progress. New criteria for taxonomic, age or sex determination or new methods for processing slaughtering ages or skeletal part frequencies must also be evaluated in the light of the results that they produce in different situations. Distinguishing wild from domestic populations, the question of either an exclusive appeal to morphological data or a use of more diverse criteria (skeletal part, age and sex frequencies, natural mortality...) should also be re-evaluated in the light of present day knowledge and of the possible relationships between early breeder human groups and their mammals in different environmental, historical and cultural contexts. A short round table at the end of the session will discuss the compatibility of the different systems for registering and processing osteo-archaeozoological data, on the way for a kind of homogenisation of practices. Indeed, we hope that all these questions can be debated not only in the restricted field of the Near East, but on a very wide geographical range.

## **THE ROLE OF ZOOARCHAEOLOGY IN WILDLIFE CONSERVATION ISSUES.**

Organiser: Ina Plug

Zooarchaeology has many applications pertaining to wildlife conservation issues: directly and indirectly. It is necessary that wildlife conservationists are made aware of the contributions zooarchaeology can bring to their field. Some applications of zooarchaeology in nature conservation are listed below.

The results of faunal analyses provide evidence for past animal populations of a region. It provides information on the ecological conditions of that environment as it was at that time. In nature conservation it is the more recent past in particular that is important in this respect.

The zooarchaeologist can assist conservationists in determining factors relevant to the depletion of animal populations; can give advice on whether relocation and/or reintroduction of animals to a region is feasible; and can sometimes identify areas of endemism. Thereby providing guidelines to the establishment of new conservation areas. Through the discipline it is often possible to assist in the identification of areas suitable/unsuitable for human settlement development.

In addition the science can provide clues on animal health, growth rates and the effect human predation has or had on animal populations. This provides insight into the effects of over-utilisation and exploitation. These have bearing on nature conservation and can assist in designing sustainable utilisation programmes, particularly in the so called third world developing countries.

Zooarchaeology also makes valuable contributions to law enforcement and forensics, with applications relating to poaching, illegal trade in endangered species and smuggling of animals and their products.

## **BEYOND CALORIES: THE ZOOARCHAEOLOGY OF RITUAL AND RELIGION**

Organiser: Sharyn Jones O'Day

The goal of this session is to place zooarchaeological investigations of human exploitation of animal resources within the broad theme of human behavior as it relates to ritual and religion. Oral presentations and associated posters in the Beyond Calories session explore specific case studies of ritual and religion from a variety geographic areas and temporal periods, including Iron Age Ireland, Rome, the American Southwest and Southeast, Polynesia, the Near East, Mesoamerica, Peru, North Africa, and Eurasia. More general theoretical approaches and methodological issues associated with identifying ritual activities from zooarchaeological assemblages are also discussed.

## **ANIMAL FATS AND OILS: APPROACHES AND SIGNIFICANCE**

Organiser: Alan Outram

Animal fats and oils played a crucial role in past economies. For some societies the quest for sufficient dietary fat was a matter of life and death. This session will not simply address subsistence, however; it is also concerned with cultural perceptions of fat and the uses of fats in crafts and as fuel. It will look into the many sources of animal fats, such as bone marrow and grease, fish oils, blubber and dairy products. A key aspect of the session will be to look into the various approaches we can take in the investigation of past fat and oil exploitation. Such approaches include the study of fracture and fragmentation of animals bones, the

analysis of chemical residues, the identification of rendering facilities in the archaeological record, palaeontomological evidence, ethnography and experimental studies.

## **EQUATIONS FOR INEQUALITY. THE ARCHAEOZOOLOGY OF IDENTITY, STATUS AND OTHER FORMS OF SOCIAL DIFFERENTIATION IN FORMER HUMAN SOCIETIES**

Organisers: Anton Ervynck and Wim Van Neer

Within a human society, inequalities occur, linked with group identity, religion, status, purchasing power and other phenomena. The inequalities often manifest themselves by differences in diet, including the consumption of animal products. Consequently, archaeozoology may be able to shed light upon these mechanisms leading to social differentiation, a statement that is corroborated by the contributions to this session.

## **INTEGRATING ZOOARCHAEOLOGY**

Organiser: Mark Maltby

Zooarchaeological research has the potential to investigate a broad range of issues also of interest to archaeological colleagues. These include diet; cuisine; trade; ritual; use of space; acculturation; rubbish disposal; production; specialisation; urbanization; status; land use. Too often such studies are not integrated and synthesised effectively. The potential of zooarchaeology to investigate these themes is not fully appreciated by many archaeologists. Similarly, zooarchaeologists should be more pro-active in seeking collaboration with specialists in other disciplines.

The papers in this session will provide a platform to debate how far such integrated approaches can be used to further our understanding about human exploitation and attitudes to animals. It will also allow discussion about how animal bone studies can contribute more fully to general archaeological research.

## **ARCHAEO-MALACOLOGY**

Organiser: Daniella E. Bar-Yosef Mayer

Mollusc shells from archaeological sites have long been identified as an important resource for understanding various aspects of material culture and paleo-economy. Shells originating in marine, freshwater and terrestrial environments are found in archaeological sites, and are known to have served as food from as early as the Middle Palaeolithic. Molluscs from shell middens are often used not only to reconstruct the human diet, but also to reconstruct the season of occupation as well as paleoclimates, using isotopic and other methods. In later periods, shells were collected as or made into artifacts, exchange items, grave goods, etc. with various symbolic meanings attached to them. Mollusc exploitation is also manifested in the use of certain species for the production of textile dye and construction materials. All of these aspects, from diet and paleoenvironmental reconstructions to symbolism of shell amulets will be discussed in this session.

## **NEANDERTHAL ECOLOGY**

Organiser: Ariane Burke

The subject of Neanderthal ecology has attracted wide interest lately, largely due to the efforts of archaeozoologists interested in studying subsistence strategies and patterns of land use in a variety of different environments. It has become apparent that we are dealing with a situation of hitherto unsuspected complexity, and that Neanderthals demonstrate considerable behavioural flexibility in their subsistence strategies across both space and time. This symposium brings together researchers interested in exploring this variability on both intra- and inter-regional scales.

## **COASTAL ADAPTATIONS IN ARID ENVIRONMENTS**

Organisers: Mark Beech and Caroline Cartwright

Early humans have systematically exploited marine foods in all parts of the global coastal landscape (Bailey and Parkington 1988). New carbon and nitrogen stable isotope values for human remains dating back to the mid-Upper Palaeolithic in Europe indicate significant amounts of aquatic foods in some of their diets (Richards et al. 2001). This session however aims to highlight the latest zooarchaeological research concerning the systematic exploitation of marine foods in more arid regions of the world. In some of these regions, such as Eastern Arabia, considerable attention is also being paid to identifying the complex research objectives involved in the work on past marine resources (e.g. Uerpmann 1989, Desse 1995 and others). It is in such arid areas where marine resources often provide an invaluable role, not only as a necessary source of protein for survival, but also as a source of raw material for craft production, trade or other forms of social or economic exchange. The papers in this session aim to examine the changing relationship between marine resources in different cultural, economic and environmental settings.

Bailey, G. and J. Parkington. (1988). The archaeology of prehistoric coastlines: an introduction. In: G. Bailey and J. Parkington (eds). *The Archaeology of Prehistoric Coastlines*. pp.1-10. Cambridge: Cambridge University Press.

Desse, J. (1995). Archio-ichthyologie du golfe Arabique et de l'ocian Indien. pp.72-78. In: H. Buitenhuis and H.-P. Uerpmann (eds.). *Archaeozoology of the Near East 2*. Leiden, Backhuys Publishers.

Richards, M.P., P.B. Pettit, M.C. Stiner and E. Trinkhaus. (2001). Stable isotope evidence for increasing dietary breadth in the European mid-Upper Paleolithic. *Proc. Natl. Acad. Sci. USA*, Vol. 98, Issue 11, 6528-6532, May 22, 2001.

Uerpmann, H.-P. (1989). Problems of archaeo-zoological research in Eastern Arabia. Oman. Istituto Italiano Per Il Medio Ed Estremo Oriente 58: 163-168. *Studies - Papers on the Archaeology and History of Oman*. P.M. Costa and M. Tosi (eds.). Rome.

## **ARCHAEOZOOLOGY AND ARCHAEOLOGICAL HERITAGE MANAGEMENT**

Organiser: Roel C.G.M. Lauwerier

During the last decades archaeology has been increasingly influenced by a multitude of external factors which include political initiatives, social processes and economic developments. As a direct consequence, perhaps one of the most important and rapid developments in the field has been the emergence of archaeological heritage management. Archaeozoology (and archaeozoologists) have had to adapt to this new relationship; one which has resulted in a change in both the academic and economic status of the discipline and which has led to many in the field becoming more closely involved with the 'management of

archaeological resources'. This session will aim to explore some manifestations of this relationship from a variety of perspectives.

## **RECENT ADVANCES IN THE ANALYSIS AND INTERPRETATION OF ANIMAL DIET AND MANAGEMENT**

Organisers: Ingrid L. Mainland and Mike Richards

Understanding how past societies controlled animal diet through the regulation and management of foraging and grazing and/or the provision of supplementary fodder has wide relevance for archaeology, allowing insight into various socio-economic factors including: animal domestication; the goals, productivity and viability of both pastoral and arable farming systems; the social and economic function of particular animals in society; the impact of pastoral farming on the environment. Insight into the dietary behaviour of non-domesticated species is equally important in providing evidence for past environments and for climatic change. Many of the traditional sources for identifying animal diet used by archaeologists are limited by the inability to identify a direct relationship between diet and the consumer; although it might be apparent from the archaeobotanical or entomological record that a plant attested to as fodder by relevant historical or ethnographic accounts was present within a settlement, the actual use of this substance as fodder has largely to be assumed. This session will primarily consider new advances in the analysis of dental/skeletal morphology (e.g. dental microwear) and bone chemistry (e.g. isotopic studies) which by focusing on the animals themselves have the potential to allow a more direct insight into animal diet and management in the past.

## **HUMAN AND ANIMAL MIGRATION AND COLONISATION**

Organiser: Stephen Wickler

Interdisciplinary research in archaeology, genetics and historical linguistics has begun to rehabilitate models of migration and colonisation in explaining episodes of extensive cultural change. But what this might mean in terms of human behaviour, and the relevance of cognate animal behaviour, are not yet very clear. It is intended that this session provide an opportunity to define and discuss some of the pertinent issues. Papers are invited on any aspects of human and animal migration and colonisation, most especially from perspectives drawing upon zooarchaeological evidence. Potential contributors might like to consider the following general topics, amongst others of their own choosing:

- the archaeological documentation of migration and colonisation amongst other kinds of mobility
- contrasting claims and cases of migration, diffusion and independent development
- the application of ecological, sociological and cognitive models of migration and colonisation
- behavioural comparisons and contrasts between human and animal migrants and colonists
- continental versus island colonisation models and cases, including biogeographical approaches
- pattern and process in migration episodes, notably in relation to cause; what starts episodes of migration and why do they stop?

## **BEYOND 'INTERESTING SPECIMENS': PALAEOPATHOLOGY AND ITS CONTRIBUTION TO THE STUDY OF ANIMAL HUSBANDRY.**

Organisers: Richard Thomas, Jessica Davies & Marian Fabiš

The relegation of pathological observations to little more than a brief description, which is typically lacking in integration with the rest of the evidence, is unfortunately a frequent occurrence in animal bone reports. There is a general a tendency for pathologies to be reported as "an interesting case of x" rather than any attempt to understand their archaeological implication. For example, it can often be read in site reports that there were 'x' cases of a particular condition which were recorded. The conditions are often described, accompanied by a plate and given a diagnosis that is usually followed by a reference to Baker and Brothwell (1980). However, there is invariably no attempt at calculating the prevalence of that condition, nor any attempt to understand the implication for human-animal relationships - the very rationale of zooarchaeology. Such an approach has meant that there is a general consensus that the study of animal palaeopathology is of limited potential in providing information regarding animal husbandry.

In this session, papers go beyond this approach of merely describing pathology and demonstrate its potential for providing a significant contribution to the understanding of animal husbandry.

## **THE CONTRIBUTION TO ZOOARCHAEOLOGY OF FOSSIL AND MODERN NON-ANTHROPOGENIC BONE ACCUMULATIONS**

Organisers: Philippe Fosse, Jean Philip Brugal and Liora Kolska Horwitz

For several years, reconstruction of human subsistence (food procurement, use of animal resources, human/mammal relationships s.l.) become integrated into a global taphonomic history in which non anthropic bone producing/modifying parameters have an outstanding importance. Because numerous (pre)historic sites yield both human and non human bone accumulations/modifications, distinction between these bone modifiers and characterization of each intervening agent appear to be of the greatest interest for old and new world (zoo)archaeology. Although researches on this topic do exist for more than a century, qualitative and quantitative characterization of accumulations/modifications by both biological agents (carnivores, birds of prey, (large) rodents) and non biological one (climatic-, edaphic- and diagenetic agents; water) are still to identify specifically, because of mutual relationships between them, in time (syn- vs diachronical bone discard) and space (inter vs intrasite use). Commonest agents of bone modifications in "open" and "closed" sites (fluvio-lacustrine context/cave, shelter, dwellings) are: carnivores (*Crocuta*, *Hyaena*, *Canis*, *Panthera*, *Lynx*, *Ursus*, *Gulo*, *Meles*), birds of prey (Accipitridae, Falconidae, Strigidae, Tytonidae), (large) rodents: (*Hystrix*, *Marmota*); non biological one are: weathering, hydraulic transport, fossilization, bioturbation. Pluridisciplinary approaches, coming either from modern and fossil samples or from experiments, dealing with biology of (polytypic) species (ethology, diet), replica of macro- and microscopic taphonomic parameters, have to provide precise zooarchaeological informations, connected to bony material, in our understanding of bone assemblage (de)formations (bone-beds, site (re)use, time-span of occupations).

In this workshop are presented current results on this research, with examples coming from recent excavations or experiments, with a special emphasis on non biological modifications and on modern and fossil animal bone modification.

## **BEYOND "AFFLUENT FORAGERS": THE DEVELOPMENT OF FISHER-HUNTER SOCIETIES IN TEMPERATE REGIONS**

Session Organisers: Jangsuk Kim and Junzo Uchiyama

'Affluent Foragers' has been a symbolic term used to describe the socio-economic conditions of some coastal fisher-hunters (e.g. those in the northern Pacific Rim such as the prehistoric Jomon societies and the Northwest Coast indigenous groups). This term suggests that during the Holocene certain prehistoric groups achieved highly organised social structures and high-levels of sedentism by adapting to the temperate coastal environments. However, this theory fails to reflect the dynamic process of social transition, by neglecting the facts that the various activities included in any one 'subsistence package' are interactive with each other, and that foraging cultures are not closed systems only concerned with the development of their local environments.

By including a range of recent studies world-wide, this session aims to reconsider the 'Affluent Foragers' concept, and will attempt to construct a new theoretical framework for understanding prehistoric foraging societies. Three broad themes will be explored: (1) the Development of natural environments by prehistoric fishing-hunting societies, (2) Fishing and hunting as a complex system, and (3) Internal and external interactions of fisher-hunters.

The first will primarily deal with how subsistence can be explored using faunal studies, and the topics considered can include resource controls, seasonal scheduling, and land use systems. The second will attempt to construct a new model in order to describe various fishing-hunting activities as a unified single system. Finally, questions such as: how social groups interact economically with one another (e.g. through exchange and competitive relationships), and how such interactions influence access to and the development of resources, will be addressed.

## **BEHAVIOURAL VARIABILITY IN THE SO-CALLED MARGINAL AREAS. A ZOOARCHAEOLOGICAL APPROACH**

Organisers: Mariana Mondini and Sebastián Muñoz

We are interested in exploring the variation in human/hominid adaptations and the behaviours involved in the outskirts of their geographic range. One of the most relevant dimensions of such behavioural variability is that concerning hominid niches, which is approached here from a zooarchaeological perspective.

The session is aimed at discussing the implications of the so-called 'marginal' areas, by which we mean the boundaries of the geographic range of humans and other hominid species. These areas have often been considered marginal, not only geographically but also in terms of their relevance for understanding our past. This assumption has been challenged, though, by regarding them as important as any other region for understanding hominid evolution and other aspects of our history, either in the remote past or in recent times.

We believe that if we are to understand the whole range of hominid adaptations, the so-called marginal areas have a role to play, and this session is aimed at making a contribution in this direction. Particularly, we



would like to focus on the implications of hominid behavioural variation for understanding such general issues as the reasons and mechanisms of range expansion, among others.

Apart from biogeographical marginality, we are also interested in a different but related issue: behavioural variability at environmentally marginal areas - i.e., extreme altitude, extreme aridity, etc.

The session is intended not only to illustrate the range of niche variability in these regions, but also, and specially, to bring the most general problems related to geographical marginality into discussion.

## **THE EXPLOITATION AND CULTURAL IMPORTANCE OF SEA MAMMALS**

Organiser: Gregory G. Monks

This session explores over time and space the types of sea mammals exploited by human groups. The technologies and strategies of sea mammal capture are explored, as are the cultural importance of the acquired products and the act of capture itself.

## **TAPHONOMY**

Organiser: Terry O'Connor

Understanding the transitions from life to death, death to burial, and burial to scientific study, is essential to all of our studies of vertebrate and invertebrate animal remains. Each of the many processes involved will leave a trace on individual specimens and on the assemblage as a whole, and those traces can give us information about the formation of a particular assemblage. Taphonomy has had an important place in palaeontology, from the work of Efremov and Weigelt to Allison and Martin, and zooarchaeology has both adapted principles from palaeontology and developed its own, particularly through the work of Kay Behrensmeyer and Lee Lyman.

This session will bring together papers on the taphonomy of vertebrate and invertebrate animals, including reviews of different aspects of the subject, archaeological studies in which taphonomy has played a central role, and modern experimental and empirical studies that have contributed informative observations. All stages of the taphonomic trajectory will be represented, including destruction and alteration between death and burial, in-ground diagenesis, and the effects of sampling and recovery.

## **EQUIDS IN TIME AND SPACE**

Organiser: Marjan Mashkour

The session gathers specialists in archaeozoology and related fields working on Late Pleistocene and Holocene Equids in order to review the current understanding of the cultural and natural status of this group over time and space. Methodological progress in morphometrics and molecular studies contribute to our knowledge of the various forms of equids and of their reactions to various environmental and anthropogenic influences. Interdisciplinary collaboration is of primary importance for making further progress in the study of Equids. This session is thus conceived to include as broad a range as possible of specialists in relevant disciplines.



**ALHAIQUE, F.**

**Poster:** *The role of small carnivores in the accumulation of bones in archaeological deposits: the case of the Fucino Basin sites (Central Italy).*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** In zooarchaeological studies small carnivores have often been neglected as possible causes of bone accumulation in archaeological deposits. The main reason could be that they do not kill large game; however, in some periods (e.g., at the end of the Upper Paleolithic) a widening in the range of resources exploited by humans (including small mammals and birds) has been suggested and therefore it may be relevant to assess the origin also of this portion of the faunal assemblage. The analysis of the osteological remains from the Upper Paleolithic sites of the Fucino Basin in Central Italy allowed to shed some light on the influence of foxes and mustelids on the presence of small preys in caves. Previous hypotheses regarding human behavior at these sites, based only on species list, suggested that around 13,500 years B.P. there was a dramatic change in human diet with a sharp increase in the exploitation of small mammals (mainly hare, but also marmot and hedgehog) and birds, in contrast to earlier periods in the same area. Recent re-analysis of these faunal assemblages using a taphonomic and zooarchaeological approach indicated instead that in most cases these small animals were the result of predation by small mammalian carnivores and raptors as suggested by the age composition (striking prevalence of young and very young individuals), the high frequency of carnivore marks and characteristics of bone damage (e.g., puncture mark size and location matching teeth of small mustelids and foxes). Only in few instances the identification of cut-marks and other modifications suggested human involvement in the accumulation of these small preys.

**Keywords:** small carnivores, hare, carnivore damage, Late Upper Paleolithic, central Italy.

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**ALHAIQUE, F. & CERILLI, E.**

**Poster:** *Handicraft, diet and cultural practices in the Late Imperial Villa Rustica of Brega (Rosà, Vicenza, NE Italy)*

**Session:** General

**Abstract:** The faunal assemblage from the Late Imperial Villa Rustica of Brega (Rosà, Vicenza, NE Italy) includes mainly domestic animals, although few wild species are also represented. Taphonomic analysis suggests that only livestock was surely part of the human diet while other animals were mostly the result of handicraft activities or natural accumulation. For cattle the identification of some aged individuals indicates butchering of animals already exploited for labour. The mortality

profile of the ovicaprines suggests the use also of secondary products. A large number of red deer antlers was recovered in US 341. Many of these specimens present traces of human activity such as saw and chop marks, but only the first phases of the manufacturing process are represented. The presence of shed antlers or specimens whose pedicle had been chopped from the skull, together with the almost complete absence of red deer bones, suggests that these anatomical portions were introduced only for manufacturing purposes and in many cases simply collected and not the result of hunting. The complete skeleton of a horse was recovered at the bottom of a pit (US 26). The animal was laid down on its left side in living position. Its withers height was about 133 cm. Analysis of wear stages of teeth indicates an age of about eight years and the possible use of a bit. No traces of post-mortem human modifications were detected. The dimensions and the slenderness of this specimen are comparable with those of other Late Roman horses in Central and Northern Italy, some of them also recovered in burials.

**Keywords:** diet, handicraft, horse burial, Late Imperial Age, North-East Italy.

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**ALHAIQUE, F. & MAETZKE, G.**

**Poster:** *Preliminary results on the faunal remains from the Medieval site of Ferento (Viterbo, Central Italy).*

**Session:** General

**Abstract:** The site of Ferento located near Viterbo about 90 Km North of Rome, was inhabited since the Roman times until its destruction in the 12th century. The faunal assemblage presented here is a sample coming from the Medieval levels. Almost all the identified specimens belong to domestic animals with cattle being prevalent followed by ovicaprines and pig. Equids were also recovered evidencing the presence of very small donkeys. Only few dog remains have been identified, but carnivore gnaw marks are relatively frequent suggesting that the bones in many cases were exposed for some time before being buried. Also human modifications are present and in some cases indicate manufacturing activities such as horn sheath removal, bone tool production. The faunal assemblage from these medieval levels of Ferento is therefore the result of the accumulation of both food and handicraft residues. These data are still very preliminary because the excavations are still continuing and the analysis of new faunal materials, supplemented by archaeological information, will help to investigate better possible variation within the site during the same period as well as changes through time.

**Keywords:** bone modifications, handicraft, donkey, Middle Ages, central Italy

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#### ANEZAKI, T & NISHIMOTO, T.

**Poster:** *Changes in dental size through time in the pig populations from Southern Kanto, Japan*

**Session:** General

**Abstract:** This study investigates the change in human and animal relationship based on suid remains excavated in the Japanese Archipelago. Pigs have had a close relationship with humans since prehistoric times in the Japanese Archipelago. The process of the change in this relationship, including possible domestication, has become one of the major issues in archaeozoological studies in Japan for the last several decades. This study attempts to gain a better understanding of the nature of interaction between humans and suids by investigating morphological and size differences of pig remains from the Southern Kanto, Japan. The materials used for this study date from the Early to Final Jomon (about 6100-2300BP), Yayoi (about 2300-1700BP) and Kodai (about 1700-765BP) Periods. First, the relative percentages of *Sus* were calculated to show the overall trend of pig exploitation during each period. Age at death were obtained based on the state of tooth eruption. Buccolingual crown measurements were taken in the third and fourth premolars, and in the first and second molars of the mandible. Several statistical analyses were applied to these measurement data. The age structure does not indicate any significant changes through time. The relative percentage of pigspigs decrease from Jomon to Kodai. However, four major differences were observed in the size of suids. First, the size significantly increases from Early to Middle Jomon. Second, the unimodal and bimodal distribution of the teeth measurements appears appears in the Late Jomon with no without change in the size of overall population. Third, a significant decrease in size occurs in the Yayoi Period. FinallyThen, the size again increases significantly in the Kodai. Together with the archaeological evidence such as the ritual burial of suids, we can suggest that the interactions between pigs and humans becamehad become gradually stronger atin some sites in the Late Jomon Period (about 4000-3000BP), and the relationship intensified in the Yayoi Period.

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#### ANTIKAS, T.G.

*Symbols of heroism: horse burials in royal and common Macedonian tombs*

**Session:** Equids in Time and Space

**Abstract:** The privilege of heroes and nobles to be buried with their horse(s) was explicitly described in Homer's Iliad (23.171 ff). The archaeozoological finds of horse remains and tack in the pyres of the royal tomb II at Aigai in 1977, however, was the first physical proof that such burial habits were to be practiced in northern Greece in both classical and Hellenistic times. Several horse-and-hero burials have been discovered in the turn of the 20th century from Thrace to Thessaly indicating that this ritual was not as rare a previously thought. A total of at least four horses and other species (bovine, canine, caprine, birds, fish) were placed in the pyre of King Philip's tomb at Aigai, and despite the noxious effects of high temperatures on their morphology and DNA structure it has been possible to identify charred bones using modern methods of recovery and identification. The importance of archaeozoological analysis as an aid to archaeology is emphasized in this paper, which presents comparative data from several necropoleis discovered in the north of Greece from 1977 to 2001.

**Keywords:** Horse burials, Pyres, Royal and common Macedonian tombs, Greece

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#### ARBOGAST, R., PETREQUIN, P. & VIEILLET, A.

**Poster:** *Éléments de traction animale de la fin du 31<sup>e</sup> siècle av. J.-C. dans le village néolithique de Chalain, Jura, France. (Instances of animal traction in the Neolithic village of Chalain, Jura, France, at the end of the 31th century b.c)*

**Session:** General

**Abstract:** Cette contribution est consacrée à la présentation du travail triangulaire découvert dans un village lacustre du bord du lac de Chalain (Chalain 19, Jura, France). Associée à un joug de cornes pour bovins, cette pièce, unique dans le Néolithique européen, a été datée, par dendrochronologie, des premières années du 30<sup>e</sup> siècle av. J.-C. Elle a été confectionnée à partir de deux longs patins en bois dont les têtes sont perforées et assemblées selon une technique qui semble directement inspirée de celle de l'emmanchement des haches. Outre que cette pièce constitue un indice direct du recours à la force animale, elle atteste aussi de l'emploi d'un type d'engin de transport qui pourrait dériver des premiers véhicules à roues connus, à cette époque, sur les sites lacustres suisses. La position particulière du travail et du joug, au sein de l'espace villageois où ils ont été trouvés associés à un bâtiment isolé qui se distingue par des activités spécialisées (rejets liés au travail des fibres végétales,

présence d'un métier à tisser ...) et des marqueurs de statut conduit à s'interroger sur le contexte social de l'utilisation de tels outils. Les fouilles extensives qui ont concerné ce site ont aussi permis de dégager un chemin de planches qui relie le village à la terre ferme et dont les dimensions, compatibles avec son utilisation par des attelages, corroborent indirectement l'hypothèse du recours à la force animale pour acheminer les matériaux jusqu'au village. Nous tenterons aussi de voir de quelle manière cette forme d'exploitation des animaux est restituée par les autres sources de données que représentent l'ostéologie ou encore l'iconographie.

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### **ARBUCKLE, B.S. & BOWEN, J.**

#### *Zooarchaeology and Agricultural Colonization: an Example from the Colonial Chesapeake*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** This presentation examines patterns in zooarchaeological data from the Chesapeake region of Virginia during the Colonial Period with a focus on metrical data of cattle from the period 1620-1800. Changes in species frequency, size change in cattle, and changes in the land use strategies of the colonists are put into historical context as well as in the context of a model of the process of agricultural colonization. We will argue that these changes are related to the general process of agricultural colonization, as well as historical changes in the political economy of the Chesapeake colony, which caused planters and small farmers to adapt their land use strategies to changing local conditions and overseas markets. Finally the Chesapeake data are compared with examples of agricultural colonization elsewhere in the world.

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### **ARBUCKLE, B.S.**

#### *A Reinterpretation of the Ganj Dareh goats: Problems with the use of demographic data as evidence for early domestication and a model of caprine domestication*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Based on the interpretation of sex specific slaughter profiles the site of Ganj Dareh has been identified as the earliest known site for goat domestication at about 9000 uncalibrated years bp. This paper critiques the use of slaughter profiles as

sole evidence for domestication and reinterprets the goat procurement system at Ganj Dareh in the context of a model for caprine domestication which predicts relatively rapid appearance of size and morphological change. It is concluded that intensive and selective hunting adequately and parsimoniously explains the Ganj Dareh data. Given these considerations, the best evidence for early caprine domestication is concluded to be in the late PPNB in the Levant and in the Ali Kosh phase in the eastern fertile crescent. This predicts that goat domestication took place several centuries later than is currently thought.

**Keywords:** Demographic data, Domestication, Goat, Ganj Dareh, Behavioral selection

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### **ARNOLD, E. & GREENFIELD, H.**

#### *The Origins of Transhumant Pastoralism in Temperate Southeastern Europe: A Zooarchaeological Investigation*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The temporal origins of transhumant pastoralism in temperate southeastern Europe (northern half of the Balkan Peninsula) have been debated within the archaeological literature. Previous hypotheses each propose a different point in time when transhumance would appear, ranging from the appearance of the earliest domestic animals (advent of the Early Neolithic), to the appearance of secondary product exploitation (advent of the Post Neolithic), and to the appearance of complex societies (advent of the Iron Age). This investigation seeks to test for the appearance of transhumance at the Post Neolithic juncture (c. 3300 BC). Archaeological evidence indicates significant population dispersion throughout the lower altitudes, increased areas under cultivation in the low and mid-altitudes and decreased productivity potentials for highland settlements. These changes would have resulted in less pasture available for domestic stock in the lowland. Herds would have to be moved farther away from settlements in order to find sufficient graze and forage. Transhumant pastoralism is an efficient response to this problem. It encourages exploitation of minimally utilized highland zones, less suited for agriculture. The primary technique involved the creation of harvest profiles from mandibular tooth wear and eruption data of remains from three domestic animal taxa (*Ovis/Capra*, *Bos taurus* and *Sus scrofa*). Cementum analysis of modern and archaeological mandibular *Ovis aries* and *Capra hircus* teeth provided supplementary seasonality estimates. The primary hypothesis was that transhumant pastoralism would appear at the temporal point where complementary culling patterns between highland and lowland sites in the region appear. Based on other sources of

data, such a pattern was expected to appear at the advent of the Post Neolithic. Several overriding methodological issues, including sample size and taphonomic problems, hampered this research. As a result, it was not possible to provide any strong support for any of the above hypotheses.

**Keywords:** transhumance, pastoralism, tooth wear and eruption, cementum analysis, Balkans

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**ARROYO-CABRALES, J., MORETT, L. & POLACO, O.J.**

*Tocuila and its research/public outreach program*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** We report on a mammoth-bearing site that has received much attention over the past six years, from the general public and academics from a range of institutions and disciplines. Tocuila is located in the Basin of México, about 40 km east from México City. Construction of a water cistern brought to light one of the most important Quaternary sites in México. The working area spreads over 30 m<sup>2</sup>, to a depth of 3.15 m. Excavation and stratigraphic levels were followed, and geometric position data for each bone specimen were recorded. The research was developed on an interdisciplinary and interinstitutional basis (sedimentology, palinology, geophysics, vulcanology, geomorphology, radiometry, paleontology, and molecular biology) in order to discover the processes that led to the formation of the deposit and the preservation of the mammoth remains. The initial decisions were to undertake a complete standard excavation and to leave most of the materials in place at the site. This later decision was due to both the heavy loads necessary to bring the bones into laboratory conditions and a requirement from the landowners and the community people to continue studies there. Posterior, a third decision was made for continuing the research activities as a museum project. Any research would be carried-on along with those activities designed to enhance the educational significance of the site. These activities have allowed for temporarily preserving the site, trying to carefully follow all conservation standards, and document any preservation problems. Most recently, the excavated area has been incorporated into a small museum, which holds the recovered bones on-site, many of which are preserved in-situ. Bones or replicas of them of the animals that have been found in the site are on display, along with a museographic legend and explanations about the excavations and current site formation hypothesis.

**Keywords:** Mexico, Quaternary, Fauna, Public awareness

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**ASHBY, S.**

*Understanding Human Movement and Interaction through the Movement of Animals and Animal Products*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** Recent years have seen a growing interest in migrationism, but archaeologists still lack a well defined methodology for the recognition of human movement. Zooarchaeology can provide indications of long range movement or contact, and may be of use in the differentiation of population movement and long range exchange. In order to exploit the potential of zooarchaeology, our approach must allow integration with other forms of archaeological, scientific, historical and linguistic evidence. At present our understanding of the processes involved in the initiation and perpetuation of population movement is limited, and we must learn from the work of geographers before we can define any strict recognition criteria.

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**BADENHORST, S & PLUG, I.**

*Archaeozoology, Law enforcement and Nature Conservation in the Republic of South Africa: perspectives from the Transvaal Museum, Pretoria*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** The Department of Archaeozoological at the Transvaal Museum was established in the mid 1970's. Since then, members of the Department have become involved in many aspects relating to nature conservation and law enforcement in South Africa. Members of the Archaeozoology Department are involved in the training of special police units, such as the Stock Theft Unit, the Unit for Trade in Threatened and Endangered Species, the Unit dealing with the import and export of animals and the Serious Crime Unit. Research staff of the Archaeozoology Department frequently analyse bone material for these units to serve as evidence in subsequent court

cases. Currently, the first author is mostly involved. We have used Archaeozoological identifications as source information on the distribution of animals in the past. This information can be applied where issues such as the proclamation of new and deproclamation of old nature reserves, human settlement allocations and development strategies. We also advice on relocation of animals as we are aware that past distributions do not necessarily mean that the environment is suitable for relocation at present.

**Keywords:** archaeozoology, law enforcement, nature conservation, animal relocation, Transvaal Museum

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### **BALASSE, M.**

*Distinguishing sheep from goats using carbon isotopic analysis in East African C4 grass environments.*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** Distinguishing sheep from goats in archaeological bone remains using morphological criteria has often proven difficult. In C4 grass environments, the identification could be accomplished using carbon isotopic analysis, due to differences in the feeding habits of sheep and goats. Sheep are grazers and have a relatively stable diet throughout the year. Goats are mixed feeders. In addition to grass, their diet includes a significant amount of bushes, whose relative proportions vary seasonally. Carbon isotope ratios of herbivore bones is related to that of the plants in their diet. Most bushes are C3 plants, and C3 and C4 plants differ greatly in their carbon isotope ratios ( $\delta^{13}C$ ). Therefore in C4 grass environments pure grazers (C4 plants eaters) can be distinguished from mixed feeders (C3+C4 plants eaters) by their carbon isotope ratios. The aim of this study is to determine whether sheep and goat feeding habits are different enough to allow identification using carbon isotopic analysis. Intra-tooth sequential sampling was performed on modern sheep and goat teeth collected in Kenya. Results of the isotopic analysis of enamel bioapatite confirm that in that environment, sheep and goats are clearly distinguishable using this criteria, both in the  $\delta^{13}C$  absolute values and their pattern of seasonal variation. Potential biases related to elevation and exceptional climatic conditions (aridity) are discussed. This methodology should prove extremely valuable when applied to skeleton parts whose intrinsic characteristics or preservation state do not permit identification using morphological criteria alone.

**Keywords:** sheep, goat, feeding strategy, carbon isotope ratios, tooth enamel.

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### **BALASSE, M.**

*Assessment of weaning pattern and seasonal availability of milk in prehistoric cattle and sheep by stable isotopes measurements in tooth remains.*

**Session:** Milk, Milking and Dairying

**Abstract:** Evaluating the role of milk production in prehistoric economies requires estimation of the capacity of a milk-oriented husbandry and seasonal availability of milk. Previous studies have discussed these parameters with reference to modern primitive breeds and ethnographic data on traditional herding. This paper explains how they can be estimated from the faunal remains themselves through assessment of weaning pattern and seasonality of birth by stable isotopes measurements in teeth. Two case studies are presented. The first study investigated weaning pattern of cattle at the Neolithic site of Bercy, France. Analysis of nitrogen isotope ratios in dentine provided evidence of early weaning of calves. This reflects either a shorter lactation period for Neolithic domesticated cows, or early weaning imposed by the herder in order to reserve a bigger proportion of milk production for human consumption. The second study investigated patterns of sheep birth seasonality at the Late Stone Age site of Kasteelberg, South Africa. Analysis of oxygen isotope ratios in tooth enamel revealed evidence of two lambing seasons. This may reflect a system of husbandry in which females lamb more than once a year, or a subdivision of the flock into groups where births were scheduled at different times of the year. The existence of two lambing seasons may have provided an advantage to the herders by extending the period of milk availability during the year.

**Keywords:** weaning pattern, seasonality of birth, stable isotope analysis, cattle, sheep.

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### **BAR-OZ, G. & DAYAN, T.**

*Testing the use of multivariate intersite taphonomic comparisons: Unraveling faunal exploitation in the Levantine Epipaleolithic*

**Session:** Taphonomy

**Abstract:** We carried out a detailed zooarchaeological and taphonomic analysis of two faunal assemblages from Hefzibah (layers 1-6 and layers 7-18), a major Geometric Kebaran open-air site on the central coastal plain of Israel. We compared our results to those of two other assemblages (Neve-David and Nahal Hadera V) dating to the same general period, site type,

and geographic region, using multivariate taphonomic analyses. We identified the maximum number of skeletal elements, searched for various surface modifications, and studied mode of bone fragmentation. A comprehensive analysis of taphonomic evidence, based on the comparison of 28 studied taphonomic variables, points to a preservational bias that accounts for an apparent economic pattern found in Hefzibah 1-6 that differs from the other assemblages. The poor state of preservation is reflected by multiple factors. Preservational indices, surface modification, bone density, and bone fragmentation indicate that inter-assemblage differences are related to post-depositional processes. These processes account for the marked differences in species diversity, low percentage of juveniles, and low proportion of small game in Hefzibah 1-6. The marked difference in preservation highlights the potential role of taphonomic biases in producing overt patterns that bear no real cultural or economic significance in zooarchaeological assemblages. On the other hand, similarities in the consumption practices in other preserved assemblages possibly imply analogous traditions of food transport, and processing. The three assemblages are characterized by high percentages of fresh percussion fractures of similar lengths, most of which exhibit green bone fractures, and share a similar frequency and distribution of butchery marks. Absence of selective transport of the major hunted species is supported by homogeneous representation of head-limb-toe elements. Low occurrence of axial units may suggest that carcasses have been processed before transport to the site alternatively this pattern may result from extensive processing of axial units for rendering bone grease.

**Keywords:** Epipalaeolithic; fallow deer; gazelle; multivariate analysis; taphonomic history

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COHEN, A. & BAR-YOSEF, O.**

*Middle and Upper Palaeolithic Hunters in the Southwestern Caucasus: Preliminary Results*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The southern foothills of the western Caucasus, a region located at the Eurasian-African crossroads, provide crucial information concerning the demise of the Neanderthals and the expansion of Modern Humans. Past excavations in this region established a cultural and palaeoenvironmental record, but faunal

studies were conducted solely as palaeontological investigations. A recent joint project with Georgian colleagues centers on the excavations of two sites: Dzudzuana Cave and Ortvale Klde rock-shelter. These two nearby sites provide a sequence that begins with the late Middle Paleolithic and probably incorporated most of the Upper Paleolithic archaeological manifestations in this region. The Caucasian goat (*Capra caucasica*, >90%) is the most common taxon in all the layers at Ortvale Klde, which date to late Middle Paleolithic and early Upper Paleolithic. At Dzudzuana, which contains only Upper-Paleolithic assemblages the proportion of goats decreases (~45%) in favor of the steppe bison (*Bison priscus*, ~55%). The faunal assemblages of all Middle-Paleolithic and Upper-Paleolithic occupations demonstrate similar subsistence strategies. Analysis of the prey age classes of goat and bison shows that the foragers were capable hunters, preferentially targeting prime adult prey. Taphonomic and demographic data further suggest that the remains represent active hunting and not scavenging. The taphonomic history of the two sites documents variable depositional processes. At Ortvale Klde bone fragmentation is related to human activities. Different picture emerges from Dzudzuana where high rate of weathered bones, high frequency of dry fractures, and wide distribution of bleached and eroded bones, reflect the effects of taphonomic biases. Low frequencies of carnivore activities at both sites may imply that human occupation was frequent and lasted for prolonged periods. The presence of cut marks relating to all stages of processing and the lack of selective transport among the remains of goat and bison suggest that butchering was carried out in each locality.

**Keywords:** Middle Paleolithic, Upper Paleolithic, Caucasus, Caucasian goat, taphonomic history

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**BAR-YOSEF MAYER, D.E.**

*From Statue Decoration to Floor Foundation: The role of Glycymeris in the Levant*

**Session:** Archaeo-Malacology

**Abstract:** Glycymeris is encountered in archaeological sites as early as the Middle Palaeolithic and it is suggested, based on ethnographic analogies, that they may have been for the transportation of fire. In the Upper and Epi-Palaeolithic they



were used as simple beads, while in the Neolithic they are found as eye insets in a plaster statue from Jericho. Other uses include body and cloth decoration, charms, ceramic polishing and more. During the Bronze and Iron Ages Glycymeris are found in Levantine tells in the thousands, and it is suggested that they were used as floor foundations to assist in the drainage of water. They were probably brought to inland sites from the coast as part as an elaborate trade network.

**Keywords:** Glycymeris, Near East, Palaeolithic, Neolithic, Bronze Age

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## **BAR-YOSEF, O.**

### *Discussant*

**Session:** Neanderthal ecology

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## **BARRETT, J. & LOCKER, A.**

*Economic intensification, long-range trade and the fish bone record of early historic Britain*

**Session:** General

**Abstract:** This paper introduces a pilot study surveying the British fish bone record from the 6th to 16th centuries AD. The project was instigated during analysis of a significant Middle and Late Saxon assemblage from Flixborough, on the Humber Estuary. It attempts to identify long-term trends in the exploitation of marine and fresh water resources in early historic Britain and to employ them as proxy indicators of economic intensification. The problem of causation is addressed by multivariate statistical analysis of spatial, functional and chronological patterning in the taxa represented.

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## **BARRETT, J., O'CONNOR, T., SIMPSON, I & ZIMMERMAN, J.**

*Small worlds and world-systems: the interface of local and regional trends in early prehistoric Orkney*

**Session:** Integrating Zooarchaeology

**Abstract:** This paper addresses the intersection of long-term local trends and large-scale world-system processes in the social and economic fabric of early historic Orkney, an archipelago off the northern coast of Scotland. It begins with a brief summary of past research regarding the relationship between economic intensification, migration and political economy. Particular attention is paid to hypotheses regarding Viking Age colonisation from Scandinavia and socio-economic transformations (including intensification of fishing and farming) which may be associated with the turn of the first millennium AD. The paper then develops an interdisciplinary methodology to test these hypotheses, and to situate them within the wider framework of European developments over the last two millennia.

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## **BARTOSIEWICZ, L.**

*Phenotype and age in protohistoric horses: a comparison between Avar and Early Hungarian Period crania*

**Session:** Ageing and Sexing

**Abstract:** Graves from the AD 6th-8th century Avar Empire in the Carpathian Basin often contain entire horse skeletons, while AD 9th-10th century Early Hungarian burials tend to yield skulls and bones from the feet, interpreted as remains of skinned horses. The research hypothesis, that morphometric differences existed between the skulls associated with these two historical periods was tested using 12 measurements and dental age on 56 Avar and 57 Early Hungarian specimens. Avar horse skulls were better preserved while mares, in general, were underrepresented in burials. Early Hungarian horses were, on average, two years younger than their Avar counterparts. Meanwhile the shorter skulls from Hungarian graves had significantly longer premolar rows. Since toothwear is known to result in the reduction of the oro-aboral length of P<sup>3</sup> to M<sup>2</sup> teeth, the only significantly different cranial proportion between the two chronological sub-samples seems to be age related, the differences in the studied skull measurements cannot be considered phenotypic. When the age and sex of animals are taken into consideration, many of the differences in shape may be attributed to the divergent compositions of the two chronological sub-samples. There is a strong cultural bias in what used to look like phenotypic differences between the two studied groups of horses.

**Keywords:** horse ontogeny, sexual dimorphism, horse burials, Central Europe, horse craniometry

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## **BARTOSIEWICZ, L.**

*Scavenger transport and human settlement: a comparison of two open air sites*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** Taphonomic loss is, to a great extent, a consequence of bone destruction by scavenging animals. Transport, prior to final ingestion, is part of the process. During the course of excavations at the Neolithic settlement of Csabdi-Télizöldes in western Hungary, experiments were carried out to better elucidate this question. Having observed two sheep carcasses at two locations, near a farmstead and in a forest clearing, it was hypothesized that the proximity of settlement in the first place influenced multiple non-human bone modifier activity. Access by scavengers (wild pig vs. canids) seemed different at the two loci and the intensity of activity also varied. This hypothesis was tested by measuring the speed of transport and rate of disappearance of two sets of 30 raw, standard-size cattle stylopodium diaphyses. These were placed in the two aforementioned locations, and revisited at regular time intervals when the spreads of the remaining bone clusters were measured relative to their original center. In the proximity of the farmstead, standard-size bones became more intensively dispersed during the studied time interval, and they also disappeared at a faster rate. This was attributed to the apparently exclusive role played by dogs, unfazed by human presence. In the forest, even the undisturbed pile of bone was decreasing more slowly in spite of the quiet environment. Evidence of wild boar activity was seen here, although traces of canids (dog and fox) could also be observed. While human proximity did not directly interfere with dog scavenging, it modified the composition of scavengers by scaring away wild competitors to dogs.

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## **BARUCH, I., ARTZY, M., HELLER, J., BALENSI, J. & HERRERA, M.D.**

*Molluscan fauna from Late Bronze and Iron Age strata at Tell Abu Hawam.*

**Session:** Archaeo-Malacology

**Abstract:** Tell Abu Hawam, is an ancient harbour city within the limits of modern Haifa, on Israel's Mediterranean coast.

Situated between Cyprus and the Nile Delta, it was a major commercial center in the latter half of the second and most of the first millennia BCE. The molluscan fauna was investigated in order to shed light on the environment of the immediate confines of the site and on ancient human activities. Material from 10 squares from the 1985-6 excavation and one square from the 2002 rescue excavation were studied. Seven thousand and thirty specimens (belonging to 73 species) were identified to the species level. The human activities include traces of purple dye production. There is also a floor paved with *Nassarius* sp. and occasional beads. Indication of long distance trade with Egypt and the red sea was noted as well.

**Keywords:** Tell Abu Hawam, purple dye production, Late Bronze Age, Iron Age, Coastal site

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## **BATHURST, R.R.**

*Poster: A case of canine tuberculosis in a 16th century Iroquois village*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The skeletal remains of a dog burial uncovered from a 16th century Neutral Iroquois site in Ontario, Canada display a distinctive osteological condition called canine hyperpulmonary osteoarthropathy, also referred to as Marie's Disease. A proliferation of new bone exostoses primarily on the lower limbs is characteristic of the advanced stages of this condition, to which the animal most likely succumbed. The disease is usually caused by a pulmonary mass or pulmonary tuberculosis, the latter of which may be transmissible between dogs and humans. Marie's Disease has been previously documented in both human and canine skeletal remains from pre-contact North and Central America. This poster serves to illustrate the distinguishing characteristics of the canine affliction, and considers the implications of this disease and its aetiology to associated human communities.

**Keywords:** dog; tuberculosis; Iroquois; Marie's disease; paleopathology

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### **BAXTER, I.L.**

*A dwarf hound skeleton from a Romano-British grave at York Road, Leicester, England, U.K.; and a discussion of other Roman small dog types*

**Session:** General

**Abstract:** In the course of an excavation outside the Roman town walls of Leicester in 1997 the complete skeleton of a small dog was found on the base of a full-sized human grave dating from the fourth century AD. The York Road specimen is of particular interest as a complete skeleton of a type of small dog frequently encountered on sites of the Roman period, generally as scattered cranial and postcranial remains, typified by having short bowed legs and a resemblance to the modern Dachshund. The skeleton is described and the cranial and appendicular morphology of this type is compared to those of Roman dogs with more rounded crania and straight limbs, which anatomically more closely resemble the modern Toy Poodle or Pomeranian breeds

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### **BAXTER, I.L. & HAMILTON-DYER, S.**

**Poster:** *Evidence for the commercial exploitation of the red fox (*Vulpes vulpes* L.) and other fur bearing mammals in Saxo-Norman (10th-12th century AD) Hertford, Hertfordshire, U.K.*

**Session:** General

**Abstract:** Recent study of a large assemblage of animal bones from Saxo-Norman (10th-12th century AD) deposits recovered at Millbridge, Hertford, identified the remains of several fur bearing mammals and in particular foxes. The bones are from multiple contexts and mostly comprise elements of the foot and tail. It is suggested that these remains constitute rare archaeological evidence of commercial exploitation during this period.

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### **BECKER, C.**

*On the divergent exploitation of marine resources in two Bronze Age Mediterranean sites*

**Session:** Archaeo-Malacology

**Abstract:** As will be highlighted from the analyses of bone and shell material from two Bronze Age sites, one at the coast of Istria/Croatia, the other from Northern Greece, the exploitation and utilisation of marine molluscs may vary to a great extent, despite a similar location and environment and despite a comparably easy accessibility of such resources. In one site, people used shelled invertebrates exclusively as food whereas in the other, molluscs were also exploited as a source for purple-dye production, as receptacles, as ornaments and magical objects, in addition to their dietary contribution. It is tried to investigate the reason for such divergent behavioural patterns. Attention must be placed both on settlement structures and on the socio-economic organisation of the sites compared here.

**Keywords:** Eastern Mediterranean sites, Bronze Age, marine molluscs, diversified utilisation, cross-cultural comparison.

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### **BEJENARU, L.**

*Teaching archaeozoology in Romania*

**Session:** General

**Abstract:** In 1964, the first doctoral dissertation in Romania in Archaeozoology was authored by Sergiu Haimovici, under the guidance of Olga Necrasov. During the last decades many students were encouraged to choose subjects from archaeozoology for their Diploma Thesis, some of them being already published. Starting from 2001, a archaeozoological course was included in the academic curricula of the Faculty of Biology, 'Al.I.Cuza' University of Iasi. A complementary teaching programme, 'Archaeozoology and Palaeozoology Summercourses', is organised as a Socrates Intensive Programme by three European universities: Universitatea 'Al.I.Cuza' Iasi, Rijksuniversiteit Groningen, AND Universita degli studi di Bari.

**Keywords:** teaching, archaeozoology, Romania, academic curricula, summer courses.

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### **BEJENARU, L., TARGAN, C. & STANC, S.**

*Hunting in Medieval Moldova: archaeozoological data*

**Session:** General

**Abstract:** In the Middle Ages, the physical and geographical environment of Moldova has undergone changes, especially due to changes in population size. The less severe impact of humans on the environment at the beginning of the II nd millennium A.D. may be interpreted as a result of a low population density and the level of technological development. Big sizes of red deer

(similar to those of red deers from Neolithic and Geto-Dacian Periods) were deduced from faunal remains, and may be related to these conditions. With increased population densities by the end of the millennium, changes in vegetation and fauna took place. The intensification of human activities has especially led to deforestation. As a result, the spreading area of some species such as *Cervus elaphus* and *Ursus arctos* decreased. Excessive hunting during these times may have also been responsible for the extinction of some species such as *Bison bonasus* and *Bos primigenius*. Assemblages from Medieval sites in Moldova show a low proportion of wild mammals. Frequencies vary between 0.4 % and 11.06 % of the total number of identified mammal remains. Hunting activity may as well be interpreted in view of hunting rights and restrictions. Documentary sources show that restrictions were applied to ordinary people, and that only the aristocracy had access to hunting. Poor people were allowed to hunt only in order to pay their obligations in meat and furs. Both, private and state regulated domains were protected against the utilization of wood, grazing, fishing, and hunting.

**Keywords:** hunting, Middle Ages, Moldavia, archaeozoology, documents

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#### **BELMAKER, M**

*Using Comparative Micromammal Taphonomy to Test Paleoeological Hypotheses - 'Ubeidiya, a Lower Pleistocene site in the Jordan Valley, Israel, as a Case study.*

**Session:** Taphonomy

**Abstract:** 'Ubeidiya is situated in the central Jordan Valley, Israel and has been dated to ca. 1.5 million years ago. Tectonic movements have caused the sediments to fold and fault which allow analysis along a temporal sequence. Two strata (III 12 and I 26) have been selected to test changes in environment within the 'Ubeidiya sequence using micromammals. The micromammal assemblage of stratum III 12 is significantly more heterogeneous than I 26. In Stratum I 26 nearly 100% of the species prefer habitats of forest and moist steppe, while in stratum III 12 up to 20% have preferred habitats of dryer regions such as arid steppe, mesic steppe and cliffs. Two alternative hypotheses are put forth: 1. The catchment area is the same in both strata. The environment is heterogeneous including forest and open steppe. The percent of closed vs. steppe vegetation is a function of humidity. Thus, the presence of mesic species in III 12 and their subsequent disappearance in I 26 is evidence for increasing humidity. 2. The environment in both strata is of homogenous ecological zones surrounding 'Ubeidiya paleo-lake. Thus, the appearance of mesic species in III 12 reflects a larger catchment area, which brought elements from a source (ecological zones) further away from the sink ('Ubeidiya paleo-lake) as opposed to I 26 with a smaller catchment area. Catchment area is a function of predator type and transport. Taphonomic parameters are used to distinguish

between the two alternative hypotheses. If the former hypothesis is true, we expect a similar taphonomic pattern for both strata. If the latter is true, we expect stratum III 12 to show evidence of either a wider ranging predator and/or fluvial transport for a longer period of time and/or higher energy level. Results presented will distinguish between the two hypotheses put forth.

**Keywords:** Micromammals, predators, transport, Pleistocene, Jordan Valley

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#### **BENECKE, N. & HANIK, S.**

*Dogs for the living and the dead - on the exploitation of dogs in Mesolithic Europe*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** This paper presents results of studies on dog remains from the Early Mesolithic (Middle Pre-Boreal - Boreal) settlement site Friesack near Berlin as well as from the Late Mesolithic (Late Atlantic) cemetery at Skateholm in Southern Sweden. The material from Friesack shows that dogs were used for different purposes at this site. Cutting marks on the bones as well as the state of fragmentation reflect their use for human food and the exploitation of their furs. The use of dogs for human consumption has been demonstrated from a number of sites in Mesolithic Europe. Except for some sites on the Danube (region of the Iron Gate) where the consumption of dog meat seemed to have been significant, dogs played a minor role in this respect in most areas. In some regions like South Germany, the total absence of dog bones in large Mesolithic bone collections could indicate that there was a taboo in eating dog meat. Beside economic exploitation, dogs were often used in human burials obviously expressing man's close relationship with this animal. In Europe, the practice of dog burials started right at the beginning of canid domestication at the transition from the Pleistocene to the Holocene. The earliest evidence comes from Bonn-Oberkassel (c. 12000 cal BC). An extraordinary Mesolithic site with many dog burials is Skateholm. Here, 12 skeletons, or parts of skeletons, have been recovered from two burial grounds. Judging from the development of dentition and the degree of epiphyseal fusion in the postcranial skeleton the buried dogs were either puppies or young animals in their prime (1-2.5 years old). It is doubtful whether a selection was made in terms of size. The findings suggest that the dogs found in the dog burials largely reflect the overall variation range of Late Mesolithic dogs in the southern Baltic region. The dogs obviously were in a good general state of health, no pathological changes being discernible in any of the skeletons. The archaeozoological analysis does not corroborate

the theory that it was predominately sick dogs no longer useful for hunting or other purposes which were buried.

**Keywords:** Mesolithic Dogs; Europe; Exploitation (Food, Furs); Dog burials

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**BIGNON, O., EISENMANN, V.,  
BAYLAC, M. & VIGNE, J.-D.**

*Late Glacial diversity of Western European horses and implications for human bands : morphometrics and geometric morphometrics approaches*

**Session:** Equids in Time and Space

**Abstract:** This study has the Late Glacial for the framework: the period starts conventionally at 15,000 BP and ends at the beginning of the Holocene, ca. 10,000 BP. Almost all of the archaeological collections studied here belong to the Bölling and Alleröd chronozones; the latter are known to have had a relative temperate climate. Many studies have been done on the human societies of the Late Glacial in Western Europe which provided the picture of an economy based on reindeer hunting (namely for the Paris basin's Magdalenian). Nevertheless, 1990 discoveries showed that Paris basin's Magdalenians were important consumers and skilful hunters of wild horses. This paper attempts to join palaeo-environmental and cultural approaches since environment and culture should have been intimately linked at the Bölling/Alleröd periods. Our main goal is to consider wild horse's diversity in order to understand the extend of migrations and the relative isolation of populations. The characterisation of equids (*Equus gallicus arcelini*) has been realised with morphometrics and geometric morphometrics, between three distinct areas: Switzerland Plateau, Paris Basin and Charente (France). On the one hand, the results point out anatomical convergences essentially on the third phalanx (being a good indicator of environment) ; on the other hand, geometric morphometrics clearly shows that metacarpal conformations are different in each area. The use of this new methodology for archaeological data allows to distinguish what we could call "regional populations" and suggests the absence of wild horse's long distance migrations. This issue is of importance, in the way that this big game should have been present globally during all year round and could thus be hunted without any seasonal restriction. Late Glacial could be divided in those following palynological chronozones: oldest Dryas (15,000–12,700 BP), Bölling (12,700–12,000 BP), Alleröd (12,000–11,000 BP), and finally younger Dryas (11,000–10,000 BP).

**Keywords:** Wild horse, Magdalenian, Paris Basin, Geometric Morphometric, Regional populations

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**BOCHENSKI, Z.M.**

*Birds as prey of owls and diurnal raptors – a taphonomic approach*

**Session:** Taphonomy

**Abstract:** Bird remains derived from archaeological sites may be either of human or non-human origin. One of the most important factors from the latter category comprises owls and diurnal birds of prey. There have been a number of studies analyzing damage to bird bones in food remains of particular species of raptors; their taphonomic signatures have been described and used to analyze archaeological materials. As the relevant papers are scattered in archaeological and zoological journals, it seems useful to summarize the available information in one place. This paper is the first approach towards it. Signatures left on bird bones by various species of owls and diurnal birds of prey will be compared and the most important characters will be pointed out. Such problems as differentiating between pellet and uningested food remains, inter-specific variation, sampling methods and the way of presenting original results will be discussed. Examples of taphonomic analyses successfully applied to archaeological materials will be shown.

**Keywords:** taphonomy, bird bones, pellets, food remains, digestion.

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**BOCHERENS, H.**

*Contribution of bone stable isotope biogeochemistry to the reconstruction of Neanderthal ecology in western Europe.*

**Session:** Neanderthal ecology

**Abstract:** Carbon and nitrogen isotopic abundance in bone collagen directly reflect those of the protein fraction of average diet. When collagen is well preserved in fossil bone, its isotopic

signatures provide direct information on the type of plants consumed by herbivores, as well as the type of prey consumed by predators. Collagen isotopic abundances have been shown to be preserved in fossil bones from western European sites as old as 200,000 years BP. Neanderthals aged from 120,000 to 30,000 years BP in France, Belgium and Slovenia have been compared to coeval mammal faunas in order to reconstruct the structure of the trophic web as well as the position of Neanderthals within this trophic web. Using this approach, it has been possible to investigate the influence of forested environments on mammalian fauna, including Neanderthals, during the last interglacial (Marine Oxygen Isotope Stage 5, Eemian stage 1.). A reconstruction of the trophic structure of the so-called « mammoth-steppe » of Marine Oxygen Isotopic Stage 3 is proposed, with a determination of the position of Neanderthals within this food web. Finally, the possible trophic changes for Neanderthals at the transition between Middle and Upper Palaeolithic are examined closely. The conclusion that can be drawn from the available data is that Neanderthals were strongly reliant on large herbivore meat protein, and that even during forested episodes, predation was preferentially aimed at herbivores from open environments. Moreover, the kind of prey that entered into the Neanderthal diet does not seem to change significantly during the last thousand of years of their occurrence in Europe.

**Keywords:** Neanderthal, Middle Palaeolithic, carbon isotope, nitrogen isotope, dietary reconstruction

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**BOCHERENS, H. & DRUCKER, D.**

*Stable isotope biogeochemistry of Upper Pleistocene and Holocene European Equids, implications for palaeobiological and archaeozoological investigations*

**Session:** Equids in Time and Space

**Abstract:** Carbon and nitrogen isotopic abundances in bone collagen and carbonate fraction directly reflect those of the average diet of a given individual. Especially carbon isotopic signatures vary in plants due to environmental conditions, and it is possible to distinguish between forested and open environments. Equids are classically considered as herbivores linked to open steppe environments. Carbon isotopic data measured on Equus skeletal remains ranging in age from around 120,000 years BP to the Middle Neolithic (around 4,000 years BC) globally exhibit values typical of open-environment herbivores, except for two periods: during the Eemian and the Atlantic periods, some horses exhibit very low  $^{13}\text{C}$  amounts typical of herbivores consuming plants growing under a closed canopy in a forested environment. Some horse populations could thus subsist in forested environments, although in low numbers. A detailed comparison of isotopic compositions measured in Horse, Bovid and Reindeer from Southwestern France between 35,000 and 12,000 years BP also shows some differences between Marine Oxygen Isotopic Stage 3 and 2, possibly reflecting differences in the adaptation of bovid and

horse to very cold conditions. Isotopic biogeochemistry also allowed to compare the biotope of Equus and Hydruntinus during the Upper Pleistocene. The obtained results show no clear difference between both genera when coeval, and different results from the Holocene populations from Central Asia. Isotopic biogeochemistry thus provides very valuable insights on the palaeobiology of ancient equids relevant to the understanding of the relationships between equids and humans.

**Keywords:** carbon-13, nitrogen-15, collagen, bioapatite, equid

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**BOGATKINA, O.**

*A New Method of Size Reconstruction in Subfossil Beavers (Castor fiber L.)*

**Session:** General

**Abstract:** The research is devoted to the problems of reconstructing mammals' size. This issue is of special interest for archaeozoologists dealing with bone fragments of subfossil animals. The author has given proof to a new method in reconstruction, which is based on biological and mathematical research of symmetry rules in biological bodies. The idea of symmetry rests on the notion of invariant-group properties of organism structure. The algorithm suggested by the author can be viewed as a special case in the general pattern of morphologic structure of bodies. Our method includes a new and universal approach and can occupy a fitting place among other works on structural research. This method has already received approval in the Institute for problems of ecology and evolution Russian Academy of sciences (Moscow). The concrete algorithm of bone length reconstruction was created with the beaver (*Castor fiber L.*) as the example and took the form of a mathematical formula that allowed reconstructing the size of crania and mandibula from their fragments. Originally the algorithm was developed in the study of recent species (taking their sex and age into account). Then it was introduced in the study of bone fragments of a subfossil population of mediaeval beavers (sample n=50). The Student criterion has confirmed the relevance of method usage. As the research have shown, it can be applied to most diverse biological objects.

**Keywords:** beaver, reconstruction, size, symmetry, BIOMorphology

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## **BOND, J. & MULVILLE, J.**

### *The white stuff: milking in Atlantic Scotland*

**Session:** Milk, Milking and Dairying

**Abstract:** The Northern and Western Isles of Scotland have excellent bone preservation, with neonatal material surviving to a level unsurpassed at other U.K. sites. This survival rate, coupled with total recovery strategies has allowed us to examine in detail the age structure of cattle and sheep populations on sites dating from the Bronze Age through to the Norse period. These Atlantic Islands have evidence of high level of neonatal mortality from the Bronze Age onwards, and this has been linked to milk production. In general, the situation on the various islands differs; over time the proportion of neonates decreases in the Western Isles and increases in the Northern. Work on protein residues has confirmed the presence of bovine casein in pottery for the Bronze Age, and this in conjunction with the age profiles has been used to suggest a dairy economy. A counter argument to this is that cattle died due to a paucity of fodder. However at a number of sites it is possible to demonstrate that arable and fodder production were well developed from the Iron Age. This demonstrable intensification of arable production through time would have easily provided sufficient fodder for stock. Thus the rise in neonatal mortality for the Northern Isles suggests that deliberate calf slaughter increased. There are other factors beside food production that we have to consider; in the Iron Age for example, the imposing broch towers may have been centres for social storage & redistribution. Milk and butter would play a role in this, with herds of cattle a visible statement of wealth. Later in the Norse period documentary records indicate that butter was used to pay taxes, and that to a greater extent than meat, dairy products were traded or given as gifts. This paper brings together the evidence from all the Atlantic Islands to consider the analysis and interpretation of the aging data, changes in the age structure of the stock herds over time and the advantages that can be gained from using a holistic approach to zooarchaeological interpretation.

**Keywords:** Scotland, dairying, neonatal mortality, Iron Age, Dr. Julie Bond Department of Archaeology University of Bradford, Bradford, BD7 1DP U.K. Tel: +44 (0)1274 23 3546 Fax: +44 (0)1274 23 5190 Email: J.M.Bond@Bradford.ac.uk

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## **BOND, J.M. & WORLEY, F.**

### *The other side of the fire; the roles of animals in cremation rituals*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Animal bones have been identified from cremation burials of many periods in Britain, from the Bronze Age to the Viking period. There has been little discussion of the meaning of these animal offerings and their possible roles in the cremation ritual; they are mostly assumed to be food offerings. This paper will look at new evidence from Roman, Anglo-Saxon and Viking burials and suggests many different functions for the animals which were placed on the funeral pyres. Although some may have been food offerings for the dead or perhaps even the remains of a funeral feast, other animals served more complex roles. Some may have been companion animals (e.g. horses, dogs), yet others indicators of wealth or status, whilst the burial context of some animal remains (such as the deposition of fox jaws with Anglo-Saxon women and bear skins with high-status men) suggests that they may have a totemic function. The differences in offerings between the periods studied suggests changing ritual functions for the wide range of domestic and wild animals identified. These studies have shown that even the smallest fragments of cremated bone may be essential to the interpretation of each grave assemblage.

**Keywords:** cremation, Britain, first millennium, animal offerings, social identity

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## **BORRERO, L.A.**

### *The Archaeozoology of the Andean Dead Ends in Patagonia: Living near the Continental Ice Cap*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The Continental Ice Cap extends more or less continuously between 46 and 51° 30' S. Its first known crossing by humans, in the 1950s, is a measure of its magnitude as a geographical barrier. Many proglacial lakes, separated by notches of moderately high terrain, with a belt of Nothofagus forests, are located East of the Ice Cap. These zones constitute biogeographic dead ends, limited by the Cordillera and the lakes. The Ice Cap was the western limit for the expansion of human populations and other species for the last 12,000 years. It is known that Patagonia was peopled near the end of the Pleistocene, a time at which this formidable barrier was even higher. The archaeological record suggest an early Holocene exploration of these zones. The occupations are characterized by the exploitation of modern faunas. Moreover, even when the andean deer (*Hippocamelus bisulcus*) is present, most of the species are from the steppe, especially guanaco (*Lama guanicoe*). Thus, the faunal assemblages do not differ significantly from those recorded away from the Cordillera. This pattern may be related with the existence of a less attractive and marginal environment near the Cordillera that ranked very low for

humans. It was marginal in relation with the main circulation corridors in Patagonia, and also in terms of its offer of resources. The available evidence shows the presence of megafauna, which means that the bioproductivity of the area was adequate for humans. However, the megafauna never was the main resource for the early humans. In sum, the chronologies, the rate of deposition of faunal remains and the species represented suggest that the assemblages recovered near the Cordillera are the result of asystematic utilization of the dead ends located between proglacial lakes, a pattern probably related with the progressive exploration and colonization of marginal zones.

**Keywords:** Patagonia, Holocene, guanaco, taphonomy, circulation

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**BOSCATO, P., FRANZA, V. & SALVADORI, F**

*Proposal for a faunal remains database*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** The paper considers a computerised tool for archiving and processing faunal remains. We present a database management system used by the Prehistorical Section and by the Medieval Archaeology Area of the Archaeology and Art History Department of the University of Siena. The solution, open and flexible, has been created after the experience of the LIAAM (Laboratory of Information Technology Applied to Medieval Archaeology ; <http://archeologiamedievale.unisi.it>). Evolution of the database since 1996, detailed description of its functionalities and possibilities connected with the use of it are dealt under an archaeozoological perspective. The paper faces also aspects related to information technology, such as data architecture, normalization of language, programming of user interfaces and automation utilities. The DBMS we are proposing has proved to be efficient in the practice of archaeozoological research; digital recording reduces the occurrence of errors during data entry, allows comparison between different contexts and, above all, it provides powerful tools for real time processing of one or more samples. In the future, with an increasing number of managed samples, this system should prove to be useful in producing predictive models of bone assemblages on a large spatial scale; the first results, based on three extensive excavations, seem to confirm these potentialities. It is already possible to retrieve information based on chronological periods in different topographical contexts (urban sites, villages, dispersed settlement), on morphometrical data, and on animal exploitation strategies.

**Keywords:** Archaeozoology, Database management system, Medieval, Computer applications in Archaeology, Quantitative methods.

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**BOYLE, J.**

*Crafting Status: Bone pin production in early medieval Ireland*

**Session:** General

**Abstract:** This paper examines the production and use of bone and antler pins during the 5th through 9th centuries in Ireland. Pins and brooches have long been considered the primary signifier of social status in the early medieval period, yet few works have included the role of bone and antler pins in early Irish society. In this paper I will detail the production and distribution of these pins in comparison to iron and copper-alloy examples and discuss the role bone and antler pins may have played in the Irish social system.

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**BOYLE, K.**

*Integrating Wild and Domestic Resources during the Late Neolithic of Southern Brittany: a Zooarchaeological Study of the Seal-hunting Site of Er Yoh (Morbihan)*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** This paper considers the contribution of wild resources, primarily the seal, from the Late Neolithic site of Er Yoh (Morbihan, Brittany), to the local subsistence strategy of livestock breeders occupying that area of coastal northwestern France. The site of Er Yoh is of interest because it is one of only very few in the Morbihan region where faunal material has been recovered, especially in any number. The material in this taxonomically diverse assemblage is particularly interesting as it illustrates the fact that viewing agricultural practice as a relatively homogeneous economic base of the Neolithic is a mistake, for it becomes clear that the economic base of the period in the area is far from homogeneous. The local



subsistence economy instead features a highly significant wild resource component which complements the domestic staples and which are obtained by hunting both terrestrial and marine mammalian species and birds in addition to fishing and shellfish gathering. We see, for example, prey species which include phocid seal, beaver, hare and red deer. By examining the wild assemblage (mainly seal) in terms of MNI frequencies and primary evidence of butchery and carcass management, its taphonomic status and preliminary evidence for seasonality and kill-off patterns, it is possible to determine local hunting patterns and integrate the wild and domestic components of the economy – in sum, to go some way towards establishing patterns of resource management in this coastal area four to five thousand years ago.

**Keywords:** Seals, Neolithic, Er Yoh, Brittany, France

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## **BRADLEY, D. & EDWARDS, C.**

*Bovine ancient DNA - limits and prospects*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Molecular analysis of mitochondrial DNA variation has added a layer of information to the understanding of domestication in a range of livestock species. Particularly, global patterns of mtDNA diversity are now well known in cattle and point toward multiple origins. Ancient DNA research has added a temporal dimension and identifies a strain of wild ox in western Europe which differs markedly from that in modern cattle of the region. However, such resolution at a regional level marks the biological limits of mtDNA sequence investigation. To answer questions of finer differences, autosomal markers are required. For example, an ancient DNA analysis of microsatellite variation in cattle from Viking Dublin points toward local, rather than Scandinavian origins - a distinction which was not possible with mtDNA data.

**Keywords:** Ancient DNA, Mitochondrial DNA, Microsatellite, Cattle, Domestication

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## **BRODEUR, M-E.**

*Documenting and aging the channel catfish population exploited in southern Quebec 400 B.C. - 500 A.D.*

**Session:** Ageing and Sexing

**Abstract:** Thousands of fish bones have been discovered on the sites of Pointe-du-Buisson, located in the St. Lawrence River Valley near Montreal. The channel catfish (*Ictalurus punctatus*) was the most common species identified in the faunal assemblage. This research aimed at understanding why this particular species was so intensely exploited during the early Middle Woodland Period (400 B.C.-500 A.D.) on one of these sites (Station-3-avant). The measurements from five anatomical elements of the assemblage, compared with those taken from present-day specimens, allowed the characterization of the channel catfish population exploited during this period in terms of size, age, total weight and meat weight. These data were interpreted in light of biological aspects in the specific environmental context of the site to suggest some hypotheses regarding the fishing strategies of the occupants of the site.

**Keywords:** catfish, age determination, biometry, weight determination, size dimorphism

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## **BROTHWELL, D. & DOBNEY, K.**

*Abnormal sheep metatarsals: an aetiological problem in search of environmental facts.*

**Session:** Beyond 'interesting specimens':  
palaeopathology and its contribution to the study of animal husbandry

**Abstract:** We are concerned to call attention internationally, to an abnormality on the anterior aspect of some sheep metatarsals. On the proximal half of the shaft, extending from the medial or lateral ridges of the anterior surface, there can be a mild to very well defined buttress of extra cortical bone. This does not appear to be inflammatory or traumatic, and does not usually extend beyond 50mm in length. Consideration will be given to possible alternative aetiologies. Archaeological examples will be described, with a view to stimulating interest in this neglected pathology.

**Keywords:** sheep, metatarsal, anterior aspect, pathology

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## **BROUGHTON, J.**

*Pre-Columbian human impacts on California vertebrates: evidence from old bones and implications for wilderness policy*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** The superabundance of large game during the early historic period in California astonished early European explorers and settlers. And accounts of the incredible densities of curiously tame large ungulate taxa in this setting have influenced a long-held perception that Californian Indians lived in harmony with nature and either had no impact on, or positively influenced, large game populations. However, the extraordinarily high densities of large game and the apparent conservationist strategies practiced by native groups during historic times may both be a reflection of preceding waves of European-based diseases and dramatic human population declines. Detailed analyses of archaeological faunal assemblages from California make this scenario appear increasingly likely. Informed by foraging theory, these analyses of faunal materials from a number of sites in the San Francisco Bay area and the Sacramento Valley provide evidence for substantial impacts on a wide variety of large vertebrate taxa as human population densities expanded over the last ~4000 years. The faunal evidence suggests the densities of large vertebrates were extremely low in those settings during late prehistoric times, although no species were driven to extinction. The early historic accounts of large game superabundances likely reflect rebounds of those populations after release from intensive human harvest pressure. This analysis shows that the distributions and abundances of late prehistoric vertebrates in California were fundamentally anthropogenic and has implications for conservation policies that are founded on early-historic period “benchmarks” and those that involve the management of wilderness areas by native peoples using indigenous harvesting methods. The analysis also has implications for the plausibility of Martinis “Pleistocene Overkill” model hypothesis from which conservation policy recommendations have recently been generated.

**Keywords:** human impacts, foraging theory, California, conservation biology.

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**BROWN, L. & HERON, C.**

*Presence or Absence: A Preliminary Study into the Detection of Fish Oils in Ceramics*

**Session:** Animal Fats and Oils

**Abstract:** Fish have been an important traditional resource in coastal communities; ethnographic sources and archaeological material both pointing to their exploitation. However, the visibility of the evidence is often poor. Bone may be absent or

unrepresentative for a variety of reasons, including degradation and processing away from the settlement. Artefactual evidence is also susceptible to a degree of invisibility for much the same reasons. In contrast, ceramics survive well on many sites; for example, the ceramic assemblage from the excavations at Old Scatness stands in the region of 30,000 sherds. This research examined the potential for a direct link between the exploitation of fish and the processing of derived products at a molecular level by analysing residues absorbed into ceramics. There are pitfalls in trying to answer this question in this way, mostly due to the fragile nature of the highly polyunsaturated oils associated with fish. However, there is the possibility that some of the monounsaturated oils may be detectable over long timescales and it is from this group that the putative biomarkers were taken. A series of cooked samples of cod and herring in unglazed ceramics was prepared in order to provide a data set which, coupled with informed knowledge of fish oils, was used as a model from which to test the samples of archaeological ceramics. The identification of the oils showed potential, although further work is required in refining the methodologies used in this preliminary study.

**Keywords:** Archaeological Ceramics, Fish oil, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Old Scatness

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**BRUGAL, J.-P. & JAUBERT, J.**

*Comparative Neanderthal Paleoeecology from the Middle Palaeolithic sites of South of France*

**Session:** Neanderthal ecology

**Abstract:** Ecologic approaches to ancient hominid subsistence s.l. must control both natural environments and cultural processes. Our knowledge of these external and internal factors have to be integrated in order to access Neanderthal behavioural patterns. Palaeontological (fauna, flora) and zooarchaeological data are complementary datasets for paleoenvironmental reconstruction, especially for environments exploited by people (i.e., for reconstructing the hominid niche). Age and sex structures of prey populations, skeletal representations and butchery patterns inform us about game acquisition and consumption, seasonality and human group size. Moreover, geotopographic factors are essential to evaluate settlement network and taphonomic bias. Lastly, lithic assemblages can be used to reveal mobility patterns of human groups operating within a territory. The south of France is very rich in Middle Palaeolithic sites. We propose a first synthesis of the current record from the southern border of the Massif Central (Causse) based on a dozen recently excavated sites, ranging from isotopic stage 5 to early stage 3, and offer a comparison with older sites.

The large mammal communities (herbivores and carnivores), specific game targeting strategies, lithic exploitation patterns (raw material procurement and typo-technological analyses), and topographic location will be commented upon. Finally, generalisations will be offered concerning the nature of Mousterian open-air sites in the south of France.

**Keywords:** South France, Middle Paleolithic, Lithic Technology, Subsistence patterns, Paleoecology

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**BUILTH, H.C.**

*Identifying the Aboriginal Preservation of Shortfin Eel in the Archaeological Record of Temperate Australia.*

**Session:** Animal Fats and Oils

**Abstract:** GIS analysis of a landform in Southwest Victoria, Australia, revealed large-scale landscape modification: evidence of wetland resource management and control by the local Gunditjmara people. Ethnohistorical and local oral histories have documented the importance of the shortfin eel (*Anguilla australis*) in the regional indigenous economy, however, no archaeo-zoological evidence has ever been found. Biomolecular markers were sought to provide direct evidence for human activity in relation to shortfin eel exploitation. Gas Chromatography and Mass Spectrometry (GC/MS) was used to test for lipid remains in sediment obtained from facilities that were hypothesised as having been used to preserve *Anguilla australis* by smoking. Identification of fatty acids from this resource in this context would provide proof of its preservation by Gunditjmara and therefore its storage potential. The processing of eels by Gunditjmara in this form is unknown and has socio-economic implications.

**Keywords:** Southwest Victoria Australia, Gunditjmara, *Anguilla australis*, fatty acids, GC/MS analysis.

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**BUILTH, H.C.**

*Gunditjmara Environmental Management: the Development of a Fisher-Gatherer-Hunter Society in Temperate Australia*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** An archaeological investigation of a volcanic landform occupied by the Gunditjmara of temperate southwest Victoria, Australia, has provided evidence of aquaculture as the basis of a highly organised prehistoric socio-economy. Manipulation of the landscape resulted in large-scale management of the shortfin eel (*Anguilla australis*) ensuring a perennial availability of this and other wetland resources by the time of British colonisation. Gunditjmara had developed a resource specialisation that formed the basis of sedentary settlement. In addition, seasonal trapping resulted in preservation by smoking of the shortfin eel, enabled its storage and facilitated trading. Landscape archaeology and archaeozoological evidence have led to a socio-economic model of Gunditjmara settlement that defies previously accepted models of Australian Aboriginal societies. Based on resource management, control and preservation, this fisher-gatherer-hunter society features all the pre-conditions for social complexity. The archaeological evidence supports the feasibility of regional social stratification and hereditary chiefs as described in previously dismissed ethnohistorical accounts.

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**BUITENHUIS, H.**

*Wild equids in the Holocene of Anatolia*

**Session:** Equids in Time and Space

**Abstract:** West and Central Anatolia have always been an anomaly in the geographical distribution of wild equids in the world. While equids species abound in the surrounding regions of Central and East Europe, the Ukraine, Caucasus region, eastern Anatolia, the Middle East and Africa, no wild equids were found in the western Anatolian area until the middle of the fourth millennium BC. The only remains from wild equids from this region, north of the Taurus ridges in Anatolia, came from the excavation of neolithic Can Hasan III, and were identified as *Equus hydruntinus*. In the 1980's remains from *Equus hemionus* were mentioned from Kurucay. These were however not widely published. From eastern Anatolia several sites, the most prominent being Cayönü, revealed remains from onager, *Equus hemionus*. From five sites in the Keban region in the Taurus mountain range, horse remains were published dating to the late fourth millennium BC, and provisionally identified as wild horse, *Equus 'ferus'*. This knowledge of the geographical distribution of equids in Anatolia reflected not a real situation, but the state of research in this region. Since the early 1990's, more intensive research in Central and West Anatolia has been undertaken, which shows that equids were an integral part of the wild fauna throughout the Holocene period, at least until the third millennium BC. In this paper, the equid remains from four sites in Cappadocia (Asikli, Musular, Tepecik-Ciftlik, and Güvercinkayasi), ranging from ca. 8000 BC till 5000 BC, will be discussed, and integrated with evidence from other recent

excavations in this area (Catal Höyük and related sites, Can Hasan III, Kurucay, Orman Fidanlığı and Ilipinar). From this discussion it is clear that three species of equids occurred and were sometimes common in this region. Particularly *Equus hydruntinus* occurred frequently in many of these sites, and seemed to have been an important prey for the neolithic occupants of the region. Also *Equus hemionus* was identified among the remains, although in small proportions. The identifications of these two species have been depending on dental remains, which are sometimes not the most numerous of equids remains. This raises the question of separating these species among the postcranial remains, as both are small and slender. An attempt to use metrical data has failed so far, due to lack of data of postcranial remains from *Equus hydruntinus*. A third species that also did occur regularly in the material, is much larger and has been identified as wild horse, *Equus 'ferus'*. The occurrence of this species from the earliest Neolithic in Central Anatolia, lays to rest the discussion which has been going on about the status of the horses found in the Keban area, as exemplified by Bökönyi in 1991. These can now be accepted without doubt as wild. This means that throughout the Holocene, wild horse did occur in Central and West Anatolia and the anomaly in the distribution of equids for this region was a clear example of an 'archaeological Lücke'. It raises however an important question as to the domestication of horse. The where and why of domestication of horse has always been focussed on the South European and Central Asian steppe regions. Ever since the discovery of the Dereivka remains, explanation for the domestication of horse has been based on the assumption that only in that region was a possibility for the domestication of this animal, and that explanations needed to involve the socio-cultural necessity of the people living in that area. As such, the theory for domestication of horse was and is still directly related to pastoralism or nomadism. The earliest occurrence of domestic horse in this region has now been dated to the third millennium BC. However, the occurrence of wild horse in Anatolia, must now be taken into account. In the whole of the Near East, horse occurs domestically from the early third millennium BC, but never as a species connected with pastoralism or nomadism. Horse in the Near East is very much associated with the sedentary settlements, and especially with the developing larger societies, city states and kingdoms. It seems that horse in the Near East is particularly associated with a high social status, for instance the courts and bureaucracy, and not with the peasantry. In later stages, horse becomes an element in long distance contacts and trade. It is therefore theoretically possible that the wild horse was domesticated in Anatolia in the late fourth millennium BC when these new societal system developed in Anatolia, and from where it may have spread over the rest of the Near East.

**Keywords:** Anatolia, Neolithic, *Equus 'ferus'*, *Equus hydruntinus*.

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**BUITENHUIS, H.**

*The use of character descriptives and multivariate analyses in the distinction of ovicaprids*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The distinction of sheep and goat has been a long standing item of research. The study by Boessneck, Müller and Teichert from 1966/1969 can still be considered the most important publication to date on this problem. Several authors have added to the descriptive characters mentioned in that publication since. In their study, Boessneck, Müller and Teichert do indicate that there are few characteristics that are actually decisive in establishing the species identification. Especially analysts working with Near Eastern material will have observed the problem that during the process of domestication and subsequent development of domestic breeds the characters seem to change between one stage of domestication and another. In this study a list of characteristics has been compiled, especially for the postcranial remains of ovicaprids, which in one time or another have been mentioned as helpful in the identification of sheep and/or goat. It is the purpose of this study to come to a form of standardized description of characters (and measurements) which can then be used for a more objective assessment of the identification of sheep or goat, their domestic or wild status, and possibly the changes in time and between locations that would provide a better insight in the development of domestic breeds. The author has analysed in a number of comparative collections recent material from ovicaprids from different regions and areas. The scoring of characteristic and measurements for this well-known material has been used to establish by multivariate analysis, mainly using discriminant analysis, what the statistical relations are between the different characters in terms of their use in separating species, status of domestication and possibly sex discrimination. In this paper some examples of this method and the results will be presented and the application to archaeozoological material will be shown.

**Keywords:** Ovicapridae, character description, multivariate analysis, species and sex identification

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**BURKE, A.**

*The site of Karabi Tamchin and land use patterns in the Crimean Peninsula during the Middle Palaeolithic*

**Session:** Neanderthal ecology

**Abstract:** Despite decades of archaeological research, we still lack a complete picture of the Palaeolithic settlement of Crimea. And yet, the Crimean Peninsula is strategically positioned on the southernmost margins of the East European plains – leading to the suggestion that it acted as an intermittent population reservoir, or refugium, when more northerly regions were glaciated. A composite picture of regional land-use in Crimea is

beginning to emerge as a result of recent excavation and survey. Unfortunately, most known Palaeolithic localities in Crimea lie at relatively low elevation along the limestone escarpments that form the Second Crimean mountain range. On-going excavation of the site of Karabi Tamchin, located in the upland plateaux of Eastern Crimea, indicates that Middle Palaeolithic land-use patterns were complex and variable, while also providing evidence for the use of “marginal” (mid-altitude) environments.

**Keywords:** Neanderthal, Middle Palaeolithic, Crimea, Eastern Europe, land-use

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### **BURKE, A.**

*Palaeoethology as an archaeological tool: E. hydruntinus and the Palaeolithic of Crimea.*

**Session:** Equids in Time and Space

**Abstract:** Understanding the ethology of a prey species is essential to understanding the behaviour of its predators. Palaeolithic people commonly hunted *Equus hydruntinus*, a particularly common species of prey in Middle Palaeolithic sites in the Crimean Peninsula. Despite the frequency with which it is encountered, the systematic affiliation of *E. hydruntinus* has long been a subject of controversy. Two nearly complete *E. hydruntinus* crania were recently uncovered in an archaeological context in Western Crimea. The possibility of using the information they provide to reconstruct the systematic affiliation and social organisation of *E. hydruntinus* is explored here.

**Keywords:** *E. hydruntinus*, systematics, ethology

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### **BUTLER, V.**

*Ancient Fish Records and Conservation Biology: A Case Study from the Lower Columbia River, U.S.A.*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Freshwater aquatic systems in western North America have undergone profound changes over the last 200 years owing to a range of Euro-American activities. Animal and plant populations are undergoing unprecedented declines. To minimize these losses, conservation biologists and land-use managers are attempting to restore habitats to some elusive “pristine” condition with little understanding of what those

conditions were like, how they changed over time, or the possible effects Native Americans had on habitats or biota. Archaeozoological remains that pre-date European contact can provide extremely useful histories of these ancient animals and as such, need to be considered in contemporary land-use policy. Recent study of fish assemblages from archaeological sites located on the lower Columbia River (Oregon and Washington, U.S.A.) that date to the last 1000 years illustrates how ancient fish bone records can be applied to contemporary concerns. Archaeological faunal records are compared to recent fish capture records from comparable habitats. The most striking difference is the huge abundance of exotic fishes that now occupy aquatic systems. Such a comparison of the “before” (European contact) with the “after” (European contact) graphically illustrates how much the fish biota has changed in a short time and points to the important role of exotic fishes in causing such changes. Significantly, contemporary habitat restoration efforts mainly focus on the physical habitat rather than reducing exotic fish populations. Zooarchaeological records suggest native fish populations would be enhanced if more efforts were made to reduce exotic fishes.

**Keywords:** conservation biology, fish, western North America

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### **CALLOU, C. & MONNEROT, M**

*Morphological variability and phylogeography of the European rabbit (*Oryctolagus cuniculus*): comparison of osteometric and molecular results*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** In order to evaluate the morphological variability of the rabbit with respect to both environmental conditions and man-made constraints (transfer of wild animals, domestication), morphometrical analyses have been processed on the skeleton of present day populations of both domestic rabbits (one breed) and wild rabbits of Western Europe (France, Spain, Portugal) and North Africa (Tunisia). Log-shape ratio analyses evidenced clear differences between two groups which live in two separate regions: in the South-western part of the Iberian Peninsula, and in the rest of the Peninsula, France and Tunisia. Domestic rabbits, which own to the second group, however show morphological traits different to the ones of the wild ones. These results partly meet the ones from genetic analyses which have been processed on both mitochondrial and nuclear domains. They evidenced two lineages called a and b, respectively located in the south-western Iberian Peninsula and in the rest of the area of the species (Europe, Australia, Kerguelen). More detail comparisons between morphological and molecular results will allow to discuss advantages and limits of the former with respect to the ones of the later.

**Keywords:** Geometrics morphometry, MtDNA, Rabbit, Western Europe, North Africa.

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### **CARDEN, R.F. & HAYDEN, T.J.**

*Epiphyseal fusion in the postcranial skeleton as an indicator of age at death of fallow deer (*Dama dama* L.).*

**Session:** Ageing and Sexing

**Abstract:** A set of postcranial elements (scapula, humerus, radius, ulna, metacarpal, pelvis, femur, tibia, astragalus and metatarsal) were prepared from 107 male and 81 female fallow deer from an enclosed free-ranging population. All individuals were of known age. Specimens ranged in age from neonates to 15 (male) or 22 (female) years of age. All epiphyseal regions of the selected bones from each animal were classified into five categories depending on the degree of closure of the epiphysis and/or visibility of the sutural line. The ontogenesis of closure of 29 different epiphyses/sutures is summarized and a protocol for estimating the age of archaeological or recent skeletal specimens is presented together with an evaluation of the accuracy and precision of the procedure.

**Keywords:** artiodactyl, epiphyseal fusion, age determination, ontogeny

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### **CARTER, R.**

*A Method to Estimate the Ages at Death of Red Deer (*Cervus elaphus*) and Roe Deer (*Capreolus capreolus*) from Developing Mandibular Dentition and its Application to Mesolithic NW Europe*

**Session:** Ageing and Sexing

**Abstract:** Radiographic studies have been made of red and roe deer molariform dentition from the early Mesolithic sites of Star Carr, Thatcham, Mullerup, Holmegaard, and the late Mesolithic sites of Tågerup, Segebro, Ageröd, Skateholm, Bökeberg, Tybrind Vig, Ertebølle and Ringkloster. Mandibles of known-age from various modern European populations have also been radiographed, thereby generating two comparative reference data

sets, one archaeological and one modern. The ages at death of Mesolithic juvenile red and roe deer have been assessed from the radiographs of developing molariform dentition. The results provide new evidence that red and roe deer were killed during the winter at some early Mesolithic sites and support for existing summer indicators at others. At two inland late Mesolithic sites red deer were killed during the summer and early autumn whilst at the coastal sites a mixture of seasonal evidence has been found. New models of settlement are proposed in which there was less seasonal mobility amongst both early and late Mesolithic groups. The degree of seasonal movement between early Mesolithic inland and coastal sites is considered and previous models in which there is a reliance on the postulated coastal sites are questioned. Permanent base camp status is tentatively proposed for some inland late Mesolithic sites and their role within a predominantly coastal-based economy has been reassessed.

**Keywords:** Tooth Development, Red Deer, Roe Deer, Age Assessment, Mesolithic

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### **CARTWRIGHT, C.R.**

*Fishing in the Bronze Age: the vertebrate remains from Ra's al-Hadd, Oman.*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** A rich diversity of environmental evidence was excavated from 3rd millennium BC sites at Ra's al-Hadd, Oman. The evidence of the charcoal, molluscs and fish along with that of the turtles, mammals, plant macro-remains and pollen has revealed much information about the former vegetation, climate, diet and daily life of these coastal people. The Ra's al-Hadd fish bone assemblage represents one of the richest and largest assemblages so far to be analysed from the region, and provides a valuable insight into the importance of fish as a significant prehistoric dietary resource. Observations of the fishing practices of the present-day inhabitants of the village of Ra's al-Hadd have indicated that there is a marked seasonal dependence on marine resources. This paper examines the evidence for seasonal exploitation in the past and evaluates the fish remains, not only as a significant component of human diet, but as vital evidence for the reconstruction of the palaeoecology of the area.

**Keywords:** fish bones, seasonality, 3rd millennium BC, Ra's al-Hadd, Oman

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### **CARTWRIGHT, C.R. & WHITE, B.**

*The exploitation of Jasus lalandii (rock lobster) along the west coast of the Cape, South Africa; feast or famine food?*

**Session:** Coastal Adaptations in Arid Environments

From published research, notably by A. Jerardino, R. Navarro and P. Nilssen, there is now a greater understanding of the exploitation in the past of the Cape rock lobster (*Jasus lalandii*) along the Western Coast of the Cape in South Africa. Most of the remains have been recovered from coastal shell-middens, caves or rock-shelters. At one such site, Elands Bay Cave, John Parkington has discovered several discrete horizons with extensive rock lobster deposits. This paper examines the evidence published from Western Cape sites and compares it with the present-day occurrence and exploitation of *Jasus lalandii* in the area. We ask the question is the rock lobster a feast or famine food?

Keywords: *Jasus lalandii*, Cape rock lobster, feast or famine?, Western Cape, South Africa

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**CASTEL, J-C., LAROULANDIE, V. & LIOLIOS, D.**

*Human and animal activities during the Solutrean occupation of Combe Saunière (Dordogne, France)*

**Session:** Integrating Zooarchaeology

**Abstract:** Multidisciplinary research conducted at the cave of Combe Saunière over the past twenty years has led to the formulation of complex hypotheses concerning site formation processes and human behaviour. Following a prerequisite taphonomic analysis, which closely integrates the faunal data with the ensemble of data recovered during excavation, we present a reconstruction of the human activities represented, ranging from the acquisition, consumption and technical exploitation of animal products, to the rejection of waste materials. Interestingly, traditional estimations based on the MNI indicate an occupation duration that is well inferior to that suggested by the presence of thousands of projectile point fragments. A dynamic integration of these data is thus necessary in order to interpret the complex human activities that occurred at this site and the evidence by which they are represented.

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**CHAIX, L**

*The role of animals in the rituals and religion at Kerma (Sudan) during the third millenium BC*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** During the third and the second millenium BC, the kingdom of Kerma played an important role in the history of north-east Africa. At the frontier between Black Africa and Egypt, the rulers of Kush were trading or fighting against their powerful neighbour. The economy of the people was essentially based on cattle and sheep breeding, with some other domestic animals like goats, donkeys and dogs. Beside their economic role, these animals represented a very important part of the funerary rituals but also in some temples where they adorned the walls. In this paper, we will present some aspects of these animals in the non-economic sphere, used as food for the death or as symbols like the numerous bucrania surrounding the graves or the decorated sheeps bearing a frontal disk in ostrich feathers.

**Keywords:** Africa, Sudan, ritual, prehistory, animal

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**CHALLINOR, C.**

*How Much did Sheep Milk Products Contribute to the Subsistence Economies of the Northern Isles: a Mere Trifle?*

**Session:** Animal Fats and Oils

**Abstract:** Results of multidisciplinary research suggest that dairy products have been part of subsistence economies in the Northern Isles (Orkney and Shetland) since at least the Late Iron Age. By the Late Norse period, foodstuffs such as butter were also being used as currency for the payment of rents and taxes. Historical and ethnographic evidence indicate that cows were the principal dairy livestock, and faunal specialists have sought to elucidate dairying practices in the archaeological record *via* cattle bone assemblages. However, the extent to which ewes' milk was utilised in antiquity is less well understood. This paper discusses the potential value of ewes' milk products to settlement economies in the Northern Isles, and the various problems associated with the identification of ewe-milking in the archaeological record.

**Keywords:** dairy products, Northern Isles, sheep, subsistence

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## CHAMBERLAIN, A. & FORBES, S.T.

### *A Preliminary Study of Microscopic Evidence for Lactation in Cattle*

**Session:** Milk, Milking and Dairying

**Abstract:** In mammals, pregnancy and lactation are periods of high calcium requirement due to the additional physiological demands imposed by the developing neonate. Physiological studies have shown that the mobilisation of skeletal calcium during pregnancy and lactation is manifest in elevated rates of bone turnover and a net loss of whole body bone mineral. However, it is not known whether milk production in cattle results in microstructural changes in bone. This study aimed to test whether modern dairy cattle show microscopic evidence of enhanced rates of bone turnover, and to determine whether archaeological specimens of cattle bone can be classified according to the patterns detected in the modern material. Samples of cortical bone were obtained from the midshafts of the femurs of four modern beef cattle, four modern dairy cattle and three archaeological cattle from a Romano-British site. Transverse thin sections were prepared using a Leitz 1600 saw microtome and osteon dimensions were measured using a computer image analysis application. A wide distribution of osteon diameter was observed in both beef and dairy cattle, but average osteon diameter was significantly smaller in the dairy cattle (mean = 136 $\mu$ m, s.d. = 48  $\mu$ m, n = 204) compared to the beef cattle (mean = 203 $\mu$ m, s.d. = 48  $\mu$ m, n = 204). The distribution of osteon diameters in the archaeological specimens followed closely the pattern observed in the modern dairy cattle. The proliferation of small diameter osteons in dairy cattle is consistent with the increased bone turnover associated with high volume lactation in these animals. However, further work is needed to establish whether the differences in osteon size distribution reflect real differences in bone physiology between beef and dairy cattle, or whether factors such as the breed of animal and age at death have an influence on bone histomorphometry.

**Keywords:** Osteons, histomorphometry, milking, dairy cattle

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## CHANDRATNE, R.M.M.

### *Some Aspects of Animal Husbandry in the Early Iron Age (900 BC-700 AD) at the Citadel Anuradhapura, Sri Lanka*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** Anuradhapura is situated in the Dry zone (average annual rainfall: 1,904mm; temperature: 27.2 $^{\circ}$ C) of Sri Lanka, where archaeological excavations were undertaken at eleven areas within the Citadel, by the Government Archaeological Department under the direction of Dr. S.U. Deraniyagala. The site has yielded over 45 C14 dates and a few thermoluminescence dates. The frequency of identified faunal specimens from the eleven areas of the Anuradhapura indicates fairly similar distribution pattern for certain areas. It is significant that these faunal remains provide some evidence for the reconstruction of the nature of fauna, man and animal relationship and environmental factors for different species. The Citadel has yielded a total of 16133 (29.93%) identified specimens while the NISP II is 3283 (5.97%). Identified domestic animals were cattle, buffalo, goat, horse, and dog. It is not clear that jungle fowl and wild pig were domesticated although they are locally available at present. The District of Anuradhapura provides variety of food resource for ruminants. Ancient fodder would have been obtained from the following locations. (a) Irrigation tank border grass land, specially developed for pasturage of animal used for cultivation, (b) river bank (c) grass covered land abandoned after shifting cultivation and (d) denude of heavy jungle cover land for grazing and browsing. It is evident that straw (paddy) was also used as a surplus food for feeding in the dry seasons. Moreover, the Early Historic (500 BC-700 AD) tiles and brick fragments bear impression of straw and rice husk. Usually, paddy fields were cultivated only during the Maha season ((October-December), where fodder was available for ruminants for over six months of the year. Furthermore, 100 acres of land sustain 160 head of cattle. Concerning ethnographic data, animals were housed near the human settlement. The Pali literature (500 AD) furnishes information for cattle-pen management. A few archaeobotanical remains were identified from the site such as *Oryza sativa*, *Vigna mungo*, *Vigna radiata*, *Sateria italica*, and *Coix lacryma*. Currently these plants are locally available.

**Keywords:** Anuradhpura Iron Age Environment Ruminants Food

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## CHARLES, M. & BOGAARD, A.

### *Livestock feeding patterns at Jeitun, a neolithic site in southern Turkmenistan, based on the analysis of charred plant remains.*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** The analysis of archaeobotanical samples from Jeitun, a neolithic site in southern Turkmenistan, has shed light on local crop and animal husbandry as well as on the little known neolithic crop spectrum of the region. In addition to the



cereal material (mainly chaff), numerous wild plant seeds have been identified including many small grass seeds (*Echinochloa*, *Stipagrostis*) and sea-blite seeds (*Suaeda* spp.). Seeds of these and other wild plant species were observed in the matrix of charred sheep/goat dung pellets, present in the majority (65%) of samples. Flowering/fruitletting times of the various wild plant species represented indicate the presence of a range of late maturing species which come into fruit after the cereal harvest. The presence of these late maturing species in the samples is explained by the presence of charred sheep/goat dung, possibly burned as fuel. Examination of the approximate annual rainfall requirements of the late maturing wild plant species suggests that relatively wet, saline environments (e.g. along stream courses) were grazed by sheep/goats after the cereal harvest in late summer/early autumn. Conversely, the annual rainfall requirements of the probable crop weed species in the samples is uniformly low, suggesting a relatively drought tolerant weed flora. The implications of these results for the understanding of plant and animal husbandry in Neolithic Central Asia are considered.

**Keywords:** Central Asia, Turkmenistan, neolithic, Jeitun culture, weed ecology, animal dung, crop husbandry,

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### CHARPENTIER, V. & PHILLIPS, C.

*The maritime industries of the pre-Islamic Erythraean Ichthyophagi*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** In a recent article titled "Erythraean Ichthyophagi: Arabian Fish-eaters Observed" Donaldson (2000) states that "To attempt to cover 2500 years is of course a very tall order for a short article such as this. Nevertheless, such a survey is possible by virtue of one prominent feature: that the fisheries of this region, as will be shown, underwent no substantial change in their technology from the earliest historical times right up until recent decades when the effects of oil exports made themselves felt". In the proposed paper, we will examine to what extent this view can or cannot be applied to even earlier times. We will first define what we consider to be the main "maritime industries" and the technologies involved. This will be followed by a review of the archaeological evidence that is available from pre-Islamic sites in Arabia. Amongst the items which will be examined are fish-hooks, net weights and floats – the basic "tackle" of the pre-Islamic Ichthyophagi. The importance of industries such as the manufacture of shell objects will also be considered.

**Keywords:** fish-hooks, net weights, floats, Pre-Islamic, Arabia

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### CHÁVEZ, J.R.

*Guinea Pig Sacrifices at El Yaral, a Prehispanic Village in Southern Peru*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Domestic guinea pigs (*Cavia porcellus*) are medium-sized rodents of economical and ritual importance in the Andean world at present. Ethnohistorical and ethnographical data record their use as food, aids in medicine, divinatory agents and for ritual slaughtering. Most ethnohistorians, ethnographers and archaeologists have assumed that these animals fulfilled the same functions in pre-Hispanic times. One way to demonstrate these assumptions is through analysis of the archaeological record. The study of 112 naturally mummified guinea pigs buried beneath the floors of four residences at the El Yaral site, a pre-Hispanic village from southern Peru (AD 1000), has documented ritual practices involving the sacrifice of these animals. Evidence concerning the use of pre and post-hispanic guinea pig is presented that confirms the continuity of ritual practices and beliefs about this animal up to the present day.

**Keywords:** Guinea pig, El Yaral, Chiribaya, natural mummification, ritual sacrifice

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### CHENAL-VELARDE, I.

*Food, ritual and other forms of exploitation? Dogs from Eretria (Greece) between the Geometric and Hellenistic periods.*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The site of Eretria, situated on the Island of Euboa, has been occupied from the end of the Neolithic to the paleo-Christian Period. Dog remains from three different archaeological contexts have been studied. In the first context, a small excavation situated southeast of the sanctuary of Apollo Daphnephoros and attributed to the Geometric Period, the skeletal remains of domesticated species were associated with fire pits. This site seems to be a place where the sacrificed animals were prepared, cooked and perhaps consumed. Two burnt teeth of a young dog were found in one of the fire pits. The second context is a pit from the Archaic Period situated northeast of the sanctuary of Apollo Daphnephoros. In this pit, the skeletal remains of several domestic species were associated

with thousands of miniature ceramic offerings. These remains are clearly consumed parts of sacrificed animals. Among them, 11 bone fragments of two dogs were discovered and studied. Some of them show clearly cut marks which are interpreted. The third archaeological context concerns two wells of the Hellenistic Period, related to houses. In the first one, at the west side of the city, a complete dog skeleton and some anatomical parts were found among the bone of other species, in several layers. In the second one, the remains of 10 complete dog skeletons associated with the skeletons of 12 human babies were excavated. These two comparable contexts are analyzed together.

**Keywords:** dogs; Greece; Geometric to Hellenistic Periods; wells; consumption

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### **CHILARDI, S.**

**Poster:** *Artemis Pit? Some dog remains from a ritual pit of the ancient town of Siracusa (Southeastern Sicily)*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** A pit was discovered in Duomo Square on the island of Ortigia, the historical centre of Siracusa and first nucleus of the Greek colony. The cathedral (the Duomo) is the ancient temple of Athena (Vth century BC) transformed into a Christian church. New excavations in the square, directed by Giuseppe Voza, Superintendent for the Arts and the Environment, brought to light the foundations of an older sacred building (an oikos) dating to the end of the VIIIth century BC, which was transformed into an actual temple in the VIIth century. Several little sacred holes (thysiai), discovered in the ground throughout the excavated area, contained fictile offerings. In one of them a painted oinochoe was found; the scene depicting a winged woman, her hands on the heads of two lions, followed by a procession of beasts. The scene was interpreted as the 'Potnia theron' (Lady of the beasts), the name used by Homer for 'Artemis Agrotera' in the Iliad. The pit was close to the northern side of the sacred building. It was excavated to a depth of 17 meters below ground level, then the presence of water and safety problems stopped exploration. Pottery found in this pit covers the chronological range from the VIIth through the IVth century BC, and consists primarily of typological classes usually related to ritual offerings. Dog remains from the pit consisted of elements of two individuals, but they do not represent complete skeletons. There are several cut marks made in order to dismember the bodies, and some of the fragments are burnt. Their context suggests that a relationship between the dog remains and the worship of Artemis could be proposed as an interesting working hypothesis.

**Keywords:** Syracuse; dogs; ritual; Archaic Age; Classical Age

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### **CHILARDI, S., GUZZARDI, L., IOVINO, M.R. & RIVOLI, A.**

*The evidence of Spondylus ornamental objects in the central Mediterranean Sea. Two cases of study: Sicily and Malta.*

**Session:** Archaeo-Malacology

**Abstract:** To date, in Sicily, the presence of *Spondylus* as ornamental object is only attested in the site of Vulpiiglia, a Neolithic settlement located on the southeastern coastal plain, where three individual burials were found. Among the gifts of one of these burials, the one of a 20-30 year-old female, ten shell-beads, made by *Spondylus*, were found. In Malta the evidence of *Spondylus* ornaments is attested in a later period, beginning with the Chalcolithic Age (Hal Saflieni phase). The goal of our research is the detailing of the technical production of *Spondylus* objects, the distribution of this special raw material among the islands of the Mediterranean area (in this specific case we will mainly deal with the *Spondylus* presence in Sicily and Malta), the context where the *Spondylus* objects were found, other finds or other unusual raw materials associated with the *Spondylus* objects, the socio-economic or socio-cultural meaning of the *Spondylus* objects. Besides, with the help of isotopic analysis, we will attempt to determine whether in Sicily and in Malta the worked *Spondylus* shells were in a fresh state or if they were collected fossilized. If the last hypothesis will be attested, we will try to consider which was the role of Sicily and Malta in the trade of the fossil *Spondylus* (objects?).

**Keywords:** Spondylus, Sicily, Malta, beads production, raw material provenience

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### **CHIU, M-Y.**

**Poster:** *Age estimation of pigs: A comparative study*

**Session:** Ageing and Sexing

**Abstract:** The pig is one of the earliest animals domesticated by humans. Pig remains are commonly recovered from archaeological excavations. Pig herding also has a close relationship with agriculture. For these reasons, distinguishing between domestic and wild pigs has been an important focus in zooarchaeology. Tooth structure defining age has often been used as an important indicator for distinguishing between domestic and wild pigs. Age estimation is a preliminary procedure in identification. There are many methods for estimating the ages of pigs. I will first review these methods, then combine the methodology developed by Grant for the age estimation of pigs with ages for the development of molars. Together, this study presents a integrative and reliable method for age estimation of pigs.

**Keywords:** age determination, suids, dental morphology, wild and domestic pigs

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#### **CHOYKE, A., VRETEMARK, M. & STEN, S.**

*Cultural Identity in Middle Bronze Age Hungary: Szazhalombatta- Földvár and the Vatya culture*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** The composition of refuse bone and worked bone assemblages is clearly affected by embedded traditions linked to identity. This identity can be seen to exist on both a regional and a very local level in the stable period of the Middle Bronze Age in Hungary. Some aspects of the way animals were butchered and bones worked operated on an unconscious level related to conservative traditions passed on within the family. Other aspects have a deliberate symbolic content related how people or groups of people saw themselves. The Vatya culture is known for a line of earthworks running through Transdanubia in Hungary. Work has been carried out at a number of these earthworks since the 1950's. Thus, refuse bones and worked bones from eight of these sites became available for study. In the beginning of the 90's more intensive, fine-grain excavations began at Szazhalombatta- Földvár which continue to the present day. The possibility emerged of comparing the mass of bones from earlier excavations and looking in detail at animal processing and bone working at one particular local. This provides a foundation with which to assess the cultural identity as reflected in human animal relationships in this period. The paper will particularly focus on differences in the treatment of horse and dog at these Vatya earthworks. Ritual slaughter of animals with their burial in pits within settlements, as a regional phenomenon linking settlements will be discussed

**Keywords:** Vatya Culture, Middle Bronze Age, refuse bone, sacrifices, worked bone

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#### **CHOYKE, A.M.**

*Archaeozoology and the transition from socialism to capitalism*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** The last 12 years in Hungary have seen the steady erosion of old archaeological traditions in research and adaptation to the new realities of funding and rescue archaeology. Previous to 1990, some significant excavation work related to development went on with the archaeologists negotiating with government agencies. However, the preferred form of research was still in the form of limited and planned excavation with its typically slow pace of work. Following 1990, with the onset of privatisation, the archaeologist now has to contend with an explosion in rescue archaeology carried out within a context of changing heritage laws and an adversarial relationship with developers of all stripes. Archaeologists and archaeozoologists are coming under immense pressure. One of the first aspects of research to suffer is post-excavational work, including studying the collected bone. Archaeologists have increasingly little time to work with faunal specialists on the temporal and provenience aspects of the sites bone material comes from, aspects which are critical for any analysis. Naturally, these factors have affected archaeozoological work to varying extents. Furthermore, because traditionally in Hungary there has been a low demand for archaeozoological work, only three archaeozoologists operate in the whole country. Since this is clearly an impossible situation, a negative feed-back has developed in which, once again, some archaeologists show little interest in even collecting animal bones. This paper will discuss the relationship between education and intellectual isolation and the care with which bone assemblages are collected. Hungarian archaeology's success in dealing with huge masses of bone (carefully collected or not) given the dearth of specialists will also be considered. Finally, the real possibilities opened up in the study of animal bones and solutions to some of the problems will be discussed in light of archaeozoological work at the Aquincum Museum in Budapest, Hungary.

**Keywords:** Privatisation, Development, Heritage laws, Education

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## COLLINS, M.

### *Bone degradation*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** The deterioration of archaeological bone presents many challenges to the interpretation and recovery and interpretation of information from the archaeological record, as well as for conservation of samples. We will present the results of a number of recent studies which attempt to integrate biomolecular, chemical and physical analyses of bone to derive a simple diagenetic scheme. We will argue that despite the apparent complexities of taphonomy and diagenesis most bones map on to one of two trajectories incipient fossilization or destruction. Fossilization represents the loss of the organic fraction but the retention of the mineral phase. Loss of bone collagen significantly impairs the physical properties of bone. Rapid loss of collagen therefore reduces the probability of fossilization resulting in a predicted thermal limit to bone survival, which potentially explains the distribution of bone observed in mid to low latitudes. Destruction is due to the loss of both organic and mineral phases, but is controlled by loss of the latter. Removal of the mineral phase by either dissolution or microbial attack exposed the collagen to biodeterioration. Most archaeological bones follow this trajectory and are therefore observed at a staging point on a pathway to complete destruction. Evidence for this comes from the lack bones displaying such features preserved in the fossil record. Butchered animal bone - except in sites with pH < 6.5 - is typically well preserved. It usually appears to following the fossilization trajectory due to the removal of tissue and rupturing of the circulatory system, a process accelerated by cooking. Human bone from inhumations tend to be following the complete destruction trajectory, due to early post-mortem alteration associated with putrefaction of the corpse.

**Keywords:** Bone, Diagenesis, Collagen, Bacteria, Taphonomy

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## COLONESE, A. & WILKENS, B.

### *The exploitation of molluscs in the late Pleistocene and early Holocene of Italy*

**Session:** Archaeo-Malacology

**Abstract:** Between the end of Pleistocene and the beginning of the Holocene coastal caves characterized by a high percentage of mollusc remains are numerous in Italy. In many cases molluscs assume great importance in the diet. In this period the exploitation of molluscs, which are of marine or terrestrial species according to the site location, is closely connected to the environmental and climatic conditions, which on one hand could increase the importance of the exploitation of a secondary food

resource, and on the other direct the choices toward the most common species. Generally, these species are those most favoured by the environmental conditions and the most easily gathered. The study of the molluscs from the Serratura cave in Campania illustrated how the change of the coastline caused an elevation of the sea level, lessening the distance from the cave to the sea and making the exploitation of sea resources easier and more productive. The proximity of a river mouth and the variation of water discharge caused alterations in salinity and in the nature of the sea bottom and consequently in the species of molluscs present. Similar situations of relations with the marine environment may be observed in other coastal caves of central and southern Italy, while in the inland caves exploitation concerns land molluscs, and sea shells are present only as objects of ornament.

**Keywords:** Molluscs, Pleistocene, Holocene, Italy, Environment, Coast

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## CONARD, N. & NIVEN, L.

### *The Fauna from Bollschweil and the Role of Proboscideans in Palaeolithic Economies*

**Session:** Neanderthal ecology

**Abstract:** Between 1996 and 1998 excavations at the open-air site of Bollschweil in the Black Forest near Freiburg yielded several hundred Pleistocene faunal remains and a dozen lithic artifacts from a small valley on the edge of a limestone quarry. The artifacts and fauna stem from a mixture of reworked limestone rubble and loess suggesting that the finds originally lay in higher position before sliding into the small gully-like valley. The finds include a handaxe and a small lithic assemblage with affinities to the southwest German Middle Paleolithic. Biostratigraphic, cultural stratigraphic and ESR data suggest a correlation with OIS 6. The faunal assemblage includes 423 macro-mammalian specimens, of which 299 could be identified to the level of genus or species. While the assemblage includes remains of horse, woolly rhinoceros, large bovid, red deer and bear, mammoth is by far the most abundant species. Mammoth remains from at least six individuals comprise nearly 80% of the assemblage. Based on age estimates from molars, juveniles and young adults are well represented, while older animals are fewer in numbers. Middle-aged animals are absent. Unambiguous anthropogenic modifications are not visible among the mammoth skeletal remains. The faunal and lithic assemblages from Bollschweil are unique in southwestern Germany and suggest that mammoths may have played a role in the subsistence patterns during the Middle Paleolithic of the region. The paper addresses possible explanations for the formation of the site, and compares the results from Bollschweil with those from other proboscidean open-air sites including Ariendorf, Lehringen and

Gröbern. Further comparisons consider the proboscidean assemblages from the caves of the Swabian Jura. While the evidence is inadequate to offer a definite interpretation, the paper presents the evidence for and against an active exploitation of mammoths by Palaeolithic hominids at Bollschweil.

**Keywords:** Neanderthal, Middle Palaeolithic, southwestern Germany, proboscidean

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### COOKE, R.

*Animals In Precolumbian Panama ("Gran Cocle"):  
Ancestors, Consorts or Food?*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Information about the pre-Columbian ritual use of animals in tropical lowland Panama comes from two sources: remains found in excavations, and images painted and modeled on pottery and other media. Animal body parts frequently found in burials provide details about mortuary ritual and sartorial behaviour, and also allude to relationships between specific animal taxa and the age, sex, rank, occupation and social affiliations of the deceased. Comparing taxa deposited in burials with those that have been identified in non-ritual contexts, e.g., house floors or rubbish dumps, helps identify which animals were visualized as food, sartorial and/or ritual resources. Comparing the presence, absence and frequency of archaeozoologically documented taxa with those that are represented pictorially can identify taxa whose role is more likely to have been religious than mundane (sea turtles and crocodiles do not seem to have been used regularly for food, but are prominent iconographically). For this process to be objective, however, it is important to factor in biogeography and human selectivity (i.e., rejection of species [e.g., monkeys, sloths and loricatoriid catfish] for food - itself a complex behavior). Using biological criteria for identifying pictorially depicted taxa, and being objective about taxonomic precision, are also sine qua non – frequently mismanaged by commentators on Panamanian pre-Columbian art. In this paper, I review data for the role animals played in the pre-Columbian society of the savannas and dry forests of central Panama between ca 2000 and 500 BP, describe how certain taxa were used ritually and identify taxa, which appear to have been imbued with a religious significance.

**Keywords:** Panama, Precolumbian, tropical lowlands, Gran Cocle, ancestors

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### COOKE, R.

*Food for the (poor) ancestors, whale teeth for the (rich) ones: animals and hierarchy in pre-Columbian Panama*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Animal remains are buried frequently in graves from the "Gran Cocle" culture region of central Panama. They include bones and teeth, which have been fashioned as artifacts, and intentionally deposited food remains. Two well-known sites (Sitio Conte and El Hatillo) revealed burials of rich and powerful males whose funerary arts included ostensible "high rank" artefacts, such as carved sperm whale teeth, deer vertebrae and manatee bone, as well as necklaces made of 100s of dog (*Canis*) and peccary (*Tayassu*) teeth. Manatee bone inserts were also used for the sword-clubs depicted on cast gold figurines of warriors (manatees are only found on the Caribbean and the bones were an important trade commodity). Recent (1992-2001) excavations at the Cerro Juan Díaz site have uncovered four burial horizons and a human skeleton sample of >400, many of which were buried with animal remains. The people interred here were not high-rank, and many more children and women were found than at the rich burial sites. This paper describes animal-human associations in "rich" and "poor" burial grounds and searches for correlations that elucidate the relationship between animal taxa and body parts and the age, sex and rank of the people whose remains came to rest in regional burial grounds before Spanish contact.

**Keywords:** Panama; pre-Columbian; burials; rank; archaeozoology

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### COPE, C.

*Butchering Patterns from 1st Century Jewish Site Yud Fat and Gamla: Beginning the Search for Kosher Practices*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The Israeli Iron Age sites of Yud Fat and Gamla were destroyed by the Romans in 66 AD. Neither was ever re-settled. Evidence presented by the principle investigators of both sites suggest they were primarily inhabited by observant Jews. As such they represent rare opportunities for reconstructing animal treatment practices current with the people of Israel on the eve of the Roman conquest. The study of faunal materials suggests nearly identical butchering patterns for both sites indicating a

strong degree of cultural affinity. Could the finding represent an early pre-diaspora form of kosher treatment? Such practices may already have been old by the middle of the 1st century AD.

**Keywords:** butchering patterns, muscle stripping, muscle groups, mysentaries, tendons

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**CORONA-M., E. & JAU-MEXIA, N.**

**Poster:** *Mammal remains at El Coroco, Mexico City.*

**Session:** General

**Abstract:** This poster presents a preliminary report from the analysis of faunal remains recovered in the locality named Coroco. This is a new archaeological site in the south area of Mexico City, discovered by chance when a public building was constructed and excavated in the last two years. In Mexico many localities have evidence of distinct settlements along the time, but in very few it has been possible an archaeozoological research, this is one of these cases. At this moment, by pottery and architectural elements we have relative ages from distinct areas of El Coroco. One area can be assigned to a Prehispanic Period (before 1521 A.C.), and another to a Colonial Period (between 17 and 18th Century), and perhaps some areas can be assigned to a 19th century. The identified mammal remains comprises: two forms of dogs, rabbits and European domestic species as cattle, pig, goat and sheep. The faunal remains from Prehispanic area most probably have been used in ritual practices. The remains of European domestic species show cultural marks by alimentary use and as raw material for tools.

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**CORRADO, A.**

*Bones and Bowls: An overview of the faunal assemblage from the Phoenician Temple site of Tas-Silg, Malta*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Animals feature strongly in areas of human life, both past and present. Across cultures they serve a range of practical purposes and embody different meaning and symbols that vary from culture to culture, reflecting human activities and beliefs. The ritual assemblage is one of the most challenging to interpret as it is a direct result of both human beliefs and behaviors, influenced to varying degrees from religious practices and economic activity. The University of Malta, has been excavating the Phoenician sanctuary dedicated to Astarte at Tas-Silg (Malta) since 1996. The excavations are on-going, though a significant amount of faunal remains have been retrieved,

enabling preliminary analysis. These remains come from a wide range of animals and often recovered from contexts in direct association with inscribed pottery and artifacts indicative of ritual behavior. Some ancient visitors to the sanctuary had close connections with the sea, for they deposited fish and sea-urchins in ceramic plates often inscribed with the name of the goddess Astarte or with that of its counterpart Tinnit. This is hardly surprising since Tas-Silg lies on a promontory overlooking the south coast of the country. Other devotees however offered land-based animals such as sheep, goat, pig, and avian fauna. This paper gives a preliminary interpretation of this assemblage. This assemblage helps us to understand how this Levantine nation adapted its religion and rituals as it migrated westwards and how this adaptation incorporated local fauna in these new colonies. The Phoenicians described their system of offerings in writing. The Marseilles tariffs, listing formulae of offerings meant to regulate the sacrificial rituals at the temple of Baal Saphon, is a written proof of Phoenician behaviors. The faunal assemblage from Tas-Silg helps us complement this textual evidence with zooarchaeological evidence for the first time.

**Keywords:** Malta, Phoenician, Tas-Silg, temple, ritual behavior

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**COSTAMAGNO, S., THÉRY-PARISOT, I., BRUGAL, J.-P., FOSSE, P. & GUILBERT, R.**

*Taphonomic consequences of the combustion of bone remains. Experimental data*

**Session:** Taphonomy

**Abstract:** Many palaeolithic sites contain a significant quantity of burnt bones. Several studies show that the combustion of the bones involves taphonomic problems. So, an experimental study was undertaken to evaluate the effects of combustion on the interpretation of the archaeological bone assemblages. Within the framework of this experimentation, we approached two types of problems: modification of the assemblages due to combustion itself and effect of the post-depositional processes on bone residues. The undertaken experiments show that combustion induces a strong fragmentation of the bones, the various bone tissues not reacting in the same way. The burnt bones were then subjected to various taphonomic processes (trampling, freezing, atmospheric agents). We thus could test the hypothesis of a differential preservation: burned and not burned bones; various types of bone tissues; bones according to combustion intensity. It appears that the combustion of the bones has as a consequence a considerable loss of information as much more than combustion was intense or durable. This loss of information has effects on interpretation of animal resources and fuels management.

**Keywords:** Combustion, burning, fragmentation, differential preservation

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**COUPLAND, G., COLTEN, R. & CONLOGUE, J.**

*Household production of salmon on the Northwest Coast of North America: radiographic evidence from the McNichol Creek Site*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** In the late prehistoric period corporate households were the main producing units on the Northwest Coast of North America, and salmon was the main food resource in the region. In this paper, we investigate variation in household production of salmon at the McNichol Creek site, a 1600 year old winter village, near Prince Rupert, British Columbia. One house (House O) is thought to have contained a high status household because it was much larger than the others, and because it yielded to excavation more artifacts associated with prestige and a wider range of faunal classes. Using radiographic images (x-rays) of salmon vertebrae recovered from House O and from three other excavated house features at this site, we determine age at death and infer species harvested by each household based on this determination. We then evaluate the hypothesis that variation among households with respect to access to the full range of salmon species is correlated with differences in household wealth and prestige.

**Keywords:** salmon, radiographic analysis, household archaeology, status and prestige, Northwest Coast of North America

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**CRABTREE, P. & CAMPANA, D.**

*The diet of Washington's soldiers at Valley Forge during the winter of 1777-78*

**Session:** Integrating Zooarchaeology

**Abstract:** In the summer of 2000 the Valley Forge Center for Cultural Resources of the US National Park service began a multi-year programme of excavation to examine the remains of

Washington's 1777-78 winter encampment at Valley Forge, Pennsylvania during the American Revolution. Excavations have focused on the remains of the First and Second Pennsylvania Brigades (Wayne's Division), and the log cabins of both enlisted men and officers have been excavated. The excavations have produced substantial quantities of 18th-century artifacts and a rich collection of faunal remains. One of the main goals of the excavation has been the reconstruction of the daily life, including diet, of Washington's troops. This paper will use archaeological data, historical sources, and faunal remains to reconstruct the diet of Washington's soldiers at Valley Forge during the winter of 1777-78.

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**CRABTREE, P**

*Contemporary Archaeological Theory, Ritual, and Religion: A Re-analysis of the Faunal Remains from the Iron Age Site of Dun Ailinne, Co. Kildare, Ireland.*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Contemporary archaeological theory has emphasized the importance of the study of ritual in the analysis of prehistoric social life. This paper presents a re-analysis of the fauna from Iron Age site of Dun Ailinne, Co. Kildare, Ireland. Rather than emphasizing the paleoeconomic aspects of Iron Age subsistence, this contribution will emphasize the information that the Dun Ailinne assemblage can provide regarding Iron Age religion and ritual feasting.

**Keywords:** Zooarchaeology, Ireland, Iron Age, Ritual, Dun Ailinne

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**CRAIG, M.**

*Metric and morphological distinctions between the os coxae of Caprid and Ovid species*

**Session:** Ageing and Sexing

**Abstract:** Os coxae from over two hundred specimens of various Caprid and Ovid species were examined for evidence of sexual dimorphism, age, and species difference. All specimens were morphologically assessed and over one hundred of these specimens were biometrically assessed. Several anatomical features previously described by Gabler (1985) provide reliable biometric separation for all three parameters of sex, age, and species. Additionally, other previously undocumented features were found which allow separation between species and sexes, one notably a distinctive *Capra aegagrus* trait.

**Keywords:** Ovids, Caprids, biometrics, sexual dimorphism, morphology

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### **CRAIG, O., CHALLINOR, C. & TAYLOR, G.**

*An integrated biomolecular approach to the identification of prehistoric dairying activities in the Scottish Atlantic margins.*

**Session:** Milk, Milking and Dairying

**Abstract:** Ancient pottery vessel use-life indicators often include organic residues and the identification of dairy lipid (fat) biomarkers in archaeological ceramics has been claimed by a number of researchers. However, susceptibility of dairy fats to use-life and post-depositional transformation has hampered unambiguous discrimination of milk from adipose tissue (body) fats based on bulk lipid composition. Complementary analytical techniques such as compound-specific  $\delta^{13}C$  measurement of specific fatty acids and immunological identification of proteins offer new opportunities for discriminating biosynthetic origins of ancient biomolecules. This paper discusses preliminary results of an integrated biomolecular approach to the identification of putative dairy residues in ancient pottery, involving bulk lipid, protein and compound-specific  $\delta^{13}C$  information. Furthermore, the paper presents comparative information from prehistoric settlement sites in both the Northern and Western Isles. Some of the likely implications of dairy product utilisation within North Atlantic island economies are discussed, with particular reference to ethnographic research carried out in the Northern Isles.

**Keywords:** North Atlantic, lipids, proteins, milk, ethnography

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### **CRAM, L.**

*The Hundred Years Rule - a century of curating archaeological animal bones in Britain.*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** This first meeting of ICAZ in the new millennium gives an opportunity to look back and forward at long term aims in excavating and studying animal bones from archaeological sites. In Britain we can look back 100 years to excavations by Pitt-Rivers in Cranbourne Chase and by the Society of Antiquaries of London at Silchester. Publication was within months of the finish of the excavations with innovative work on animal bones, particularly on sizes of animals in relation to modern breeds. Pitt Rivers stated 'A discovery dates only from the time of the record of it, and not from the time of its being found in the soil.' However generally only complete bones were kept to be available now on museum shelves and often these lack details of provenance within the site. These sites have been re-excavated in recent years with up-to-date animal bone reports. These reports follow the procedures that have been established today in Britain for the excavation, publication and deposition in a museum of the excavation archive including animal bones. These procedures ensure that the bones are available to present and future researchers so that the published results can be reinterpreted and new techniques applied. They are largely a response to the need to excavate sites before they were destroyed by development in the last century. We will do well to use the Hundred Years Rule of Peter Scott, the artist and naturalist, where in all our work we serve our successors 100 years from now as well as our contemporaries. A century ahead most archaeological sites will have been excavated in advance of development. Archaeology will be mainly the examination of material held in museums, resembling the study of the past from written documents. A discovery dates from the time of its deposition in a museum.

**Keywords:** Excavation, Publication, Museum, Curating, Reinterpretation

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### **CROCKFORD, S.**

*Thyroid hormone rhythms, dog domestication and speciation: an update.*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction



**Abstract:** At the 1st ICAZ symposium on the history of the domestic dog in 1998, I presented a novel concept describing the pivotal role that species-specific patterns of thyroid hormone secretion (TH rhythms) could have played in evolution, not only for dog domestication and breed development in particular but for animal speciation in general. This innovative hypothesis is slowly accumulating strong support from researchers in evolutionary biology and both human and veterinary medicine, as well as from anthropologists. Here I briefly review the hypothesis (that both natural and artificial selection act by isolating individual variants of species-specific TH rhythms from within populations) and discuss some of its implications, including a huge potential impact on canine and human health care.

**Keywords:** domestication, thyroid, speciation, health, evolution

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### **DAMMERS, K.**

*Using osteons for ageing and sexing*

**Session:** Ageing and Sexing

**Abstract:** Microscopic analysis of bones, teeth, and horn can yield considerable information. The most intensively studied of such structures are osteons. "Osteons" refers to the systems of conduits (and associated structures) for small blood vessels and nerves that grow and run lengthwise in compact bone of most vertebrates of reasonable size. Osteons respond to the stress and strain of life, and this allows for their use in ageing bones. Various bones, e.g., femur, humerus, and rib, have been used with differing degrees of success and accuracy. Two general approaches are used: quantitative and qualitative. The latter, used in continental Europe, appears to be easier, more objective, and probably more accurate. Both consist of determining the relative frequency or area of various kinds of osteons, their parts and/or their fragments. Much less effective and concerted have been attempts to use osteons for sexing, though under certain conditions this can be done. The methods and techniques commonly used for studying osteons, including the preparation of thin-sections with a microtome or taking of microradiographs, are not very difficult, but they do take some time to learn and to carry out. Advantages of using osteons include their being relatively resistant to fire and other abuses common to archaeological settings, their being able to be studied in small fragments of bones, and their presence in robust bones. Most but not all of this work dealing with ageing and sexing has been done on human materials. A definite need exists for extending these efforts to more taxa, especially other long-lived ones and ones with marked sexual dimorphism.

**Keywords:** osteons, age determination, sex determination, microscopic analysis, sexual dimorphism

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### **DANDOY, J.**

*Astragali; the ubiquitous bones of the Old and New World – then and now*

**Session:** Integrating Zooarchaeology

**Abstract:** Astragali or knucklebones are ubiquitous as non-food material culture items. They have been used for at least 10,000 years as divination tools, gaming pieces, personal adornments, "worry beads" and dice. Their presence has been documented throughout the world from the Middle East to Africa, Europe and the North and South American continents. Astragali have been depicted in a variety of art forms, replicated in natural and man-made materials, and found singly and in very large groupings in living quarters, temples, sanctuaries, tombs, simple graves and people's pockets. They have been ground, polished, drilled, painted, dyed, incised and filled with metal. In games the bones' sides have symbolized social strata, been used to tell fortunes, and provided choices for gambling. In short, the astragal, in its many forms and uses, reflects societal changes over time. The astragal probably represents the single longest running, multi-level, cross-cultural artifact of any faunal bone in the history of mankind. Changes in its presentation may also be a harbinger of a material culture horizon marker.

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### **DARÓCZI-SZABÓ, L. & NYERGES, E.Á.**

**Poster:** *Tradition and economy in medieval pork consumption in Hungary*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** In this paper, animal remains from two sites have been juxtaposed to illustrate different attitudes to pork consumption, an important cultural indicator in Hungarian medieval history. Over 5000 bones from the late 14th century Jewish quarter of the then Christian Buda Castle clearly reflect pork avoidance. The assemblage offers, however, a glimpse of how cattle and poultry and fish substituted for pig in the meat supplies of this established urban community in a royal centre. The taxonomic and anatomical composition of the material was compared to known religious regulations and traditional Jewish recipes. The other example is part of a more complex picture. In the mid-14th century Cumanians, an ethnic group of Central Asian origins, was settled in Szentkirály, central Hungary. These 'nomads' traditionally kept sheep and cattle. The 2000 animal remains available from the 16th century phase of this settlement show, however, that pork already played a major part in the diet. This change took place against the backdrop of 16-17th century Ottoman Turkish occupation in the area. In addition to numerous pig bones from Szentkirály, written documents and

Turkish tax rolls, also attest to the importance of these animals. Comparisons between archaeozoological evidence and written sources in both cases show an interesting interplay between economy and culture change in the daily life of the two communities. Strict observance of kosher regulations prevented Jewish inhabitants of the Buda castle from adopting pork, a staple for the Christian community. On the other hand, in the absence of an explicit taboo, Cumanians pragmatically took up pork consumption, in spite of Islamic rule that only tolerated and taxed pig keeping. In addition to the effects of religion and ethnicity, social and economic differences that possibly contributed to the marked contrast observed will also be considered.

**Keywords:** food prohibition, kosher diet, sedentism, adaptation, written sources

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#### **DARWENT, C.M.**

*The Highs and Lows of High Arctic Mammals: Temporal Change and Regional Variability in Paleoeskimo Subsistence*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The High Arctic of Canada and Greenland was first inhabited approximately 4000 years ago during a climatically warm period. Faunal remains from 30 Paleoeskimo (4200–1000 B.P.) archaeological assemblages were identified and compared to remains from an additional 38 reported zooarchaeological assemblages. The Paleoeskimo stage comprises four periods: Period 1, Early Pre-Dorset; Period 2, Middle and Late Pre-Dorset; Period 3, Early Dorset; and Period 4, Late Dorset. These periods were used as analytical units to examine changes through time and variation across space in animal use during the Paleoeskimo stage of High Arctic prehistory. Shifts in prey indices, mammalian evenness values, and gaps in occupation appear to closely follow climatic change from initial occupation to the beginning of Late Dorset. More pursuit time was concentrated on a few densely (locally) occurring taxa during Pre-Dorset and Early Dorset (Period 1–3) and shifts in faunal assemblage composition are tied closely to shifts in climate prior to abandonment of this region at the end of Early Dorset. As climate cooled, Paleoeskimo hunters adapted to this change by shifting to ringed seals. Given that the High Arctic was reoccupied in Late Dorset during relatively warmer climatic conditions, climate alone does not adequately explain the variability in Late Dorset faunal assemblages and the relative decline in artiodactyls (muskox/caribou). A relative shift from higher-benefit artiodactyls and seals to lower-benefit fox and hare, and a shift to broader and more varied taxa suggests resource depression in Late Dorset concomitant with decreased mobility and relatively higher localized population density. In

addition, walrus remains increase dramatically from less than one percent of mammalian assemblages during Pre-Dorset to an average of eight percent in Dorset-age assemblages. Finally, there is no evidence that dogs contributed in any significant way to Paleoeskimo life in the High Arctic.

**Keywords:** Canada, Greenland, High Arctic, mammals, Paleoeskimo

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#### **DAUGNORA, L.**

*Viking age horse pathologies from Middle Lithuania*

**Session:** Beyond 'interesting specimens': palaeopathology and its contribution to the study of animal husbandry

**Abstract:** Pathological changes in horse bone from Medieval Lithuanian burials (8th to 11th century) have been identified. An attempt was made to determine the causes of these pathological changes: human activity (riding, heavy traction, carrying loads, breeding) or other factors (climate, feeding conditions, genetic factors). This investigation was carried out on three groups of horses: Lithuanian riding horses from burials (8th to 11th century), horses excavated in various Norwegian archaeological sites and cemeteries (Oseberg graves 9th to 12th century, Gokstadskippet, Norway), and modern Fjordhorses and Dolehorses (from 1920 to 1953, Norway). Horses from Lithuanian burials are categorised as riding horses, they were buried wearing bits. The investigation of 150 horse skeletons from Lithuania revealed three weak anatomical regions: the forecannon, the hock and hindcannon (osteoarthritis/osteoarthritis chronica deformans tarsi; from medial surface - periostitis chronica ossificans ossium metacarpalium and desmoiditis ossificans ligamentum interosseum), the lumbar region (especially the lumbar vertebrae) and the teeth. There was also a fractured metacarpal. Identical pathologies have been observed in bones recovered from Oseberg burial grounds (IX – XI centuries). Osteoarthritis, periostitis of metapodials, spondylopathy, periarticular exostoses and digital region pathology (interphalangeal joint periartthritis and hoof periartthritis) were diagnosed. Spondylopathy on the neck, interscapular region and sacral region (degeneration of intervertebral disks, periarticular osteophytes), diseases of joints (degenerative tarsal joint disease, osteoarthritis/osteoarthritis), dental caries, traumatic fractured legs bones were associated with Norwegian Fjordhorses and Dolehorses. The vertebral column (caudal thoracic and lumbar vertebrae) and the feet (metacarpal and tarsal/metatarsal region) were found to be weak regions of the skeleton in all three groups of horses. All these different horse populations were kept under different climatic, feeding conditions and had varied functions: for riding horses, for carrying loads. Investigating riding horses, kept under different conditions in a variety of areas, it has been observed that human activity results in pathological processes not only in the typically weak regions of the horse's skeleton.

**Keywords:** Bone, pathology, Lithuanian horses, Fjordhorse.

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**DAVIES, J.**

**Poster:** *Teaching and Recording Palaeopathology*

**Session:** Beyond ‘interesting specimens’:  
palaeopathology and its contribution to the study of animal  
husbandry

**Keywords:** palaeopathology, teaching, recording, protocols,  
interpretation

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**DAVIS, S.J.M. & MORENO-GARCIA, M**

*Animals from Caldeirão cave, Portugal: carnivores or  
people as bone accumulators*

**Session:** Contribution to zooarchaeology of fossil and modern  
non-anthropogenic bone accumulations

**Abstract:** Caldeirão cave is 140 km north east of Lisbon near the town of Tomar. João Zilhão of the University of Lisbon excavated the cave during the 1980s. It contains a sequence of levels with associated cultural remains belonging to the Mousterian, Early Upper Palaeolithic (EUP), Solutrean, Magdalenian and Neolithic. Faunal remains were recovered by wet sieving. Large carnivores, especially hyaena, were common in the older periods, and became scarcer or disappear in the course of the cave’s occupation. Caldeirão provides us with an interesting zoo-archaeological puzzle. Did the cave (at least in its early periods of occupation) function more as a carnivore den? The main indicators of large carnivore presence include a) finds of their bones and teeth, coprolites, and “semi-digested” bones. All these are most common in Mousterian and EUP levels. The ratio of large carnivores to ungulates is high in the early levels. Burn marks become more abundant in later levels. The lithics to bone ratios are low in the Mousterian and EUP, but high in the Solutrean. Most remains of the equids and red deer are juvenile in the early levels and adult in the later ones. It is likely that carnivores like the hyaena at Caldeirão were less able than people to hunt and/or bring back to the cave the adults of these large herbivores. A probable decrease in hyaena activity in the course of time at Caldeirão is apparently common in Iberian sites. People used the cave more intensively. This suggests that in the Mousterian and EUP human populations were sparse. The rabbit to ungulate ratio also increases with time – another possible indicator of increasing intensity of human exploitation of the environment. These zoo-archaeological data may be

interpreted in terms of demographic pressure as is now evident in other regions.

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**DAYAN, T., SIMBERLOFF, D. & WOOL, D.**

*On time scales, morphological change, and variation: A  
close look at early domesticated dogs*

**Session:** New Methods and the First Steps of Mammal  
Domestication

**Abstract:** Morphological change in early domesticated dogs involves shortening of the facial region of the skull that is initially not accompanied by a reduction in tooth size. The resulting tooth crowding has generally been explained by the evolutionary rigidity of teeth, which makes them poorer indicators of domestication. However, many zooarcheologists rely on teeth that are often considered a correlate of body size free of ontogenetic change. Tooth size is assumed to be genetically controlled and largely independent of factors that affect ontogenetic growth. Moreover, teeth can be taken as “adult”, whereas termination of cranial growth can be ascertained only by complete suture closure, a state that is not always achieved. We tested the above assumptions in carnivorous mammals. We studied morphological change in skull and upper canine (the prey-killing organ) size in populations of the small Indian mongoose (*Herpestes javanicus*) introduced a century ago to the West Indies, the Hawaiian islands, Mauritius, the Fijian islands, and Okinawa. In 100-200 generations these populations increased in male size and sexual dimorphism; female size changes have been less and inconsistent. Thus, the teeth of *H. javanicus* show variation consistent with rapid character release, a response to relaxed selection. Our detailed research indicates that dental traits within populations of cats, wolves, and mustelids are more variable than cranial traits. Furthermore, dental traits, although highly correlated with one another, are not highly correlated with cranial traits, which are also highly correlated with one another. Thus, teeth and cranial bones may be subject to quite different selective pressures and genetic constraints and may suggest different microevolutionary scenarios. We suggest that teeth of early domesticated dogs remained large because of lack of selective pressure on this trait, rather than evolutionary rigidity. However, skull size is clearly a reliable indicator of change with domestication and can be used without reservation.

**Keywords:** Dog, Domestication, Morphology, *Herpestes javanicus*, Islands

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#### DE GROSSI MAZZORIN, J. & MINNITI, C.

*The use of dogs in foundation, purification and passage sacrifices*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The aim of this paper is to examine different ritual uses of dogs in Italy from the Iron Age to the Roman Period. Recent excavations have revealed new evidence of dog burials and sacrifices in the pre-Roman and Roman worlds. Dogs were sometimes buried in pits in ancient cemeteries, separate from their masters. It is possible that they were intended to act as companions or guardians in the journey to the Underworld, although they may also have served a purification function. Dogs were also buried in votive bothroi near several sanctuaries - probably to signify a ritual offering - or buried under the foundations of buildings. Finally, dogs were often sacrificed to various goddesses, like Genita Mana and Hecate. Like their mistresses they were overseers of cyclical times, guardians of life and the awakening of vegetation. On the other hand, since dogs were linked with the world of Death, all this evidence suggests that the ritual use of dogs was also part of a ritual passage.

**Keywords:** dog, ritual, sacrifice, Roman Age, Italy

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#### DE NIGRIS, M. & GOÑALONS, G.L.M.

*The Guanaco as a Source of Meat and Fat in the Southern Andes.*

**Session:** Animal Fats and Oils

**Abstract:** Hunter-gatherers inhabiting the southern Andes, and most of Patagonia and the Pampas have relied heavily on guanaco (*Lama guanicoe*), a wild southamerican camelid, as their main subsistence resource for most of the last 10-12 ka B.P. As guanaco meat is extremely lean, prehistoric people had to develop ways for intensively exploiting the marrow fat contained in long bones, phalanges, and mandibles. Furthermore, other strategies might have been used to cope with the depletion of animal fat resources due to seasonal stress and other related temporal incongruencies. In order to explore these ideas we present the information coming from several bone assemblages from the interior of Southern-Central Patagonia. The focus of our research will be centered on the characterization and interpretation of the processing and consumption patterns observed, based on axial and appendicular skeletal profiles in conjunction with fracturing and processing marks. As a frame of

reference, new utility indices (marrow and drying index) for this ungulate will be used to discuss the resulting patterns.

**Keywords:** Guanaco, economic anatomy, marrow & drying inde

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#### DEAN, R.M.

*Desert Adaptations in the Pre-Pottery Neolithic B: The Site of 'Ain 'Abu Nekheileh, Wadi Rum, Jordan*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The Pre-Pottery Neolithic B (PPNB) site of 'Ain 'Abu Nekheileh, located in the arid deserts of southern Jordan, is far from the wetter Mediterranean climates where the core village sites of the PPNB are found. Despite the peripheral location, in an area where rain-fed agriculture is nearly impossible, the architectural remains at 'Ain 'Abu Nekheileh suggest a surprisingly intensive level of occupation. The faunal assemblage from this site provides an opportunity to study the desert adaptations of PPNB peoples. The predominance of both wild ibex and domestic goats in the assemblage suggests that adaptations to the southern deserts of the Levant may be important in understanding the transition from ibex hunting to herding of domestic caprids during this period.

**Keywords:** Jordan, Pre-Pottery Neolithic B, desert adaptations, domestication, pastoralism

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#### DEAN, R.

*Faunal Measures of Migration and Mobility in the Early Agricultural Period in the U.S. Southwest*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** The last decade has seen a revolution in our understanding of early agriculture in the greater Southwest. Recent excavations in Chihuahua, Sonora, and Arizona suggest that Early Agricultural Period (EAP) (1200 BC-AD 100) economies may have been unexpectedly intensive, combining substantial architectural investment with a heavy reliance on corn. The discovery of highly developed early villages suggests

that the first domestic economies entered the region through migration of farmers from central Mexico, rather than through diffusion of crops, which was the previously accepted model. The sites of Las Capas and Los Pozos in southern Arizona provide two rare examples of large faunal assemblages associated with these early villages. Faunal measures of site-use intensity from these two assemblages suggest that EAP societies were fairly small and mobile, and that their imported, agriculturally-based economy may have been supplemented by native natural resources.

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#### **deFRANCE, S.D.**

##### *Late Pleistocene Maritime Adaptation on the Southern Coast of Peru*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** Quebrada Tacahuay located on the far south coast of Peru is one of the oldest expressions of maritime adaptations in the Western Hemisphere with deposits dating to more than 10,290 years ago (uncalibrated radiocarbon years B.P.). The basal cultural component occurs in a relatively thin lense of aeolian sand. Shortly after the site was used, an El Niño induce debris flow buried the early occupation under almost one meter of sediment. The sealed and very well preserved deposits were uncovered during highway construction along the Peruvian coast. Excavations from three field seasons and analyses of zooarchaeological and cultural materials indicate the intensive human exploitation of marine birds, especially cormorants and boobies. Some marine shellfish were also collected as were marine fish, including anchovies. Remains of a small quantity of marine mammal specimens are also present. Subsequent reuse of the site indicates some diet breadth expansion to include greater use of both finfish and shellfish. None of the cultural deposits indicate the use of terrestrial resources. The abundant use of marine foods indicates that the site represents a specialized coastal extraction station used by Late Paleo-Indian populations with a well-developed littoral adaptation. The juxtaposition of the rich Pacific Ocean habitat with the hyper-arid Atacama desert would have presented Late Pleistocene inhabitants with a variety of challenges. In this presentation I discuss the use of marine resources and the implications for seasonal population migration during the Terminal Pleistocene. In contrast to traditional models that favor population movement to interior locations for hunting terrestrial resources, I argue that the desert habitat would have fostered a pattern of linear migration along the coast.

**Keywords:** Andes, Peru, cormorants, Paleo-Indian, maritime

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#### **deFRANCE, S.**

##### *The Ritual and Economic Uses of Animals in Yaya-Mama Sites of Highland Bolivia*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The Yaya-Mama Religious Tradition entails a unifying ideology that is visible in the archaeological record in iconography, architecture, sculpture, and ritual paraphernalia. The tradition is found in the southern end of the Lake Titicaca basin and dates from approximately 220 B.C. to 10 B.C.. Excavations at both temple contexts and domestic settings associated with Yaya-Mama period sites have produced an abundance of faunal remains. A variety of animal offertory remains are found in association with Yaya-Mama temple contexts. Yaya-Mama temples are typically sunken stone structures located on high promontory locations of the Copacabana peninsula. One component of ritual architecture is the use of animal imagery in the form of felines, snakes, and frogs. Offering pits in association with human burials are most commonly found on the exterior of the temples. Analysis of faunal remains indicates that people inhabiting Yaya-Mama Religious Tradition sites were very self-sufficient in the use of highland faunal resources. Camelid herding, lake fishing, and some hunting provided most of the dietary protein, fat, and probably calories. This poster examines the dichotomy between animals that are deified for ritual use and the everyday use of animals of local economic importance in both offertory and domestic settings. The role of exotic animal imagery is explored as well as the economic foundations of highland Andean formative culture.

**Keywords:** Andes, Lake Titicaca, camelid herding, religion, lacustrine

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#### **DENG, T.**

##### *The climatic variations of the Late Pleistocene and the fossils of *Equus przewalskii* in China*

**Session:** Equids in Time and Space

**Abstract:** Fossils of *Equus przewalskii* were discovered widespread in a lot of the Late Pleistocene faunas and the Paleolithic sites in northern China. On the other hand, the distribution of the extant *E. przewalskii* was only in the northern Xinjiang of China and the Kobdo Basin of Mongolia. The ecological environment of the extant *E. przewalskii* proves that it exists in the winter monsoon region, and adapts to dry and cold climate. During the stage of strong summer monsoon in the Late Pleistocene, *E. przewalskii* was absent in northern China. During strong winter monsoon, on the other hand, it appeared frequently among the mammalian faunas in this region. An

analysis on the enamel carbon isotope of *E. przewalskii* indicates that C3 grass was dominant in the terrestrial ecosystem of northern China during the Late Pleistocene, which is completely different from other places in the same latitude where C4 grass was absolutely dominant. This great difference was caused by the Tibetan Plateau. A marked temperature decrease would happen in the north side of the Tibetan Plateau, while an increase in the south side. The geological distribution of *E. przewalskii* was related to the temporal and spatial variation of the East-Asian monsoon. Apparently, the migration of *E. przewalskii* on east-west of northern China was controlled by the East-Asian monsoon. The distribution of *E. przewalskii* in northern China can sensitively reflect the variation of the East-Asian monsoon. As a result, the fossils of *E. przewalskii* can be regarded as an indicator of the climatic variation in northern China since the Late Pleistocene. According to the distribution of *E. przewalskii* in the Late Pleistocene faunas and the comparison with the variation model of the East-Asian monsoon in northern China, exact ages of these faunas are able to be determined more accurately on the basis of dating data.

**Keywords:** Equus przewalskii, China, Ecological variations, Pleistocene

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#### DESHPANDE-MUKHERJEE, A.

*Exploitation of Marine Molluscan Resources during the Holocene in India.*

**Session:** Archaeo-Malacology

**Abstract:** This paper attempts to trace the nature and extent of marine molluscan exploitation in India during the Holocene period. The shell evidence from numerous Indian archaeological sites indicates a long tradition of utilizing molluscs for the manufacture of objects, as lime, for obtaining pearls and for dietary reasons. A selective exploitation of certain species such as *Turbinella pyrum*, *Pugilina bucephala*, *Chicoreus ramosus*, *Dentalium* sp., *Moneta moneta*, *Meretrix* sp. *Anadara* sp., *Crassostrea* sp., *Pinctada* sp. is revealed. The overall study emphasizes the commercial importance of these molluscs in ancient Indian economy as well as subsistence.

**Keywords:** Protohistoric, *Turbinella pyrum*, Shell Bangles, Shell working, Pearl fishing

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#### DRIVER, J.

*Food, status and formation processes: case studies from Medieval England*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Animal remains have been used to identify high status residences and associated refuse many times on Medieval sites in Britain. However, there is considerable variation between assemblages on high status sites, and only certain types of context seem to produce good evidence for status differentiation. Using examples from two sites, the role of formation processes in creating distinctive "high status" assemblages will be assessed.

**Keywords:** formation processes; Medieval; urban contexts

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#### DRUCKER, D & BOCHERENS, H.

*Some thoughts about the requirements for quantitative dietary reconstructions of Upper Palaeolithic humans in continental Europe.*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** Bone isotopic biogeochemistry is nowadays currently used as a tool for reconstructing prehistoric human diets. Such reconstructions have been classically based on comparison between the isotopic signatures of humans and the isotopic signatures of mammals of known diets. Such approach cannot go much beyond distinguishing between a vegetarian and omnivorous diet in purely continental contexts. More advanced insight can be obtained by comparing the isotopic signatures of humans to those of the expected diet resources. However, a quantitative approach requires to define in a precise way some key parameters. Firstly, an isotopic characterization of the different presumed dietary resources is necessary. Secondly, the chronological and geographical variations of carbon and nitrogen isotopic compositions of a given species must be considered. Finally, determination of the values of isotopic enrichments linked to a trophic step is the key point. Taking into account all these variations or imprecisions and their impact on diet reconstruction, we propose a new way of dealing with isotopic data. This novel approach aims at testing the different dietary hypothesis suggested by archaeological evidence, and allows the exclusion of the inconsistent dietary hypothesis. Moreover, although it does not allow the determination of the exact proportions of different food resources, it can be used to calculate the maximum part of each likely food resource with prehistoric human diet. Case studies from the Upper Palaeolithic in France will be presented to illustrate these points.

**key-words:** palaeodiet, fauna, human, carbon-13, nitrogen-15

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#### **EASTHAM, A.**

*And who is sitting in my cave ? Choughs and man in late  
Pleistocene Europe*

**Session:** Contribution to zooarchaeology of fossil and modern  
non-anthropogenic bone accumulations

**Abstract:** Choughs are attractive and ecologically sensitive  
species. Both *Pyrrhocorax graculus* Yellow billed, Alpine  
choughs and *P. pyrrhocorax*, red billed choughs have been  
present in the Eurasian Palaearctic at least since the Middle  
Palaeolithic and are frequently found in the context of hunter  
gatherer cave settlements. Their presence is interesting not  
because they were imported by humans as game but because  
they, like the Columbidae, doves, roost and nest in the same  
rocky outcrops and limestone caves and fissures under which  
humans also sought shelter and set up settlement. Whereas  
human occupation was usually temporary, the colonies of  
choughs were resident. Evidence of them continues in sediments  
which are sterile of human activity, so that any clues which they  
may give about the micro-environment of a particular period  
should be relatively free of the bias to be encountered in the  
study of hunted fauna. The ecological information to be gathered  
from the presence of choughs in these contexts depends upon an  
understanding of the ethology of two species. This paper  
attempts to relate the ornithological literature to the  
archaeological record.

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#### **EASTHAM, A.**

*Mousterian Fowling Strategies: a Hypothetical Study.*

**Session:** Neanderthal ecology

**Abstract:** The diversity of bird species which have been  
recorded on Middle Palaeolithic sites with different facies of  
Mousterian industries is large. On many sites within this period  
the number of species indicate a wide range and variety of  
individual niche requirements, seasonality and ethology. Even if  
we allow for natural deaths amongst species sharing  
accommodation with humans; allow for accidental deaths by  
natural forces, like flood wind or tide, the range of birds is still  
too varied to suggest that the majority of the remains entered  
cave sediments except by deliberate importation. Animal  
predators tend to be less eclectic and to leave their own mark  
upon their prey. If this assumption is valid and a majority of  
the birds recovered from these sites were caught by human  
hunters, then the technical means to do so was available along  
with knowledge of the behaviour patterns and seasonal habits of

individual species. This paper attempts to show that many of  
the techniques which were available to the medieval fowler,  
poacher or hungry peasant, as recorded in manuals and  
documents of the time, were also within the capacity of  
Neanderthal peoples and in terms of avian species targeted had  
similarly successful outcomes. The culling of small birds was a  
sefficient as the taking of larger game, a skill which also seems to  
have been in operation in Mousterian times.

**Keywords:** Neanderthal, Middle Palaeolithic, fowling, birds

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#### **EDA, M., BABA, Y., KOIKE, H. & HIGUCHI, H.**

**Poster:** *Ancient DNA analysis for species identification  
of albatross bones: short-tailed albatrosses disappeared  
from the Sea of Japan and the Sea of Okhotsk.*

**Session:** General

**Abstract:** There are three albatross species in the North Pacific:  
the short-tailed, Laysan, and black-footed albatrosses. The  
Laysan albatross and the black-footed albatross breed mainly in  
the Hawaiian Islands and spend the nonbreeding season in the  
North Pacific. Short-tailed albatrosses breed on Torishima Island  
and the Senkaku Islands, and are seen in the North Pacific during  
the nonbreeding season. Currently, none of these three albatross  
species occur in the Sea of Japan and they rarely occur in the Sea  
of Okhotsk. However, many archaeozoological remains of the  
species have been found in sites facing the Seas of Japan and  
Okhotsk. This suggests that these albatrosses are now less  
widely distributed than they once were. The morphological  
identification criteria of the bones of these albatrosses have not  
been established yet at the species level, although in some  
papers, identification to species level is reported. We developed  
species identification criteria based on the cytochrome-b region in  
mitochondrial DNA, and succeeded in identifying albatross  
remains found in some sites facing the Seas of Japan and  
Okhotsk, to the species level. The results of the identification  
showed that all bones analyzed belonged to only one species,  
the short-tailed albatross. This suggests that the short-tailed  
albatross was the only usable albatross species for ancient  
people in those areas and that the distribution of this species has  
contracted. We propose two possible reasons why the extent of  
short-tailed albatross distribution has decreased: 1) In the early  
1900s, some short-tailed albatross populations were over-  
hunted and became extinct along the Seas of Japan and Okhotsk,  
and 2) The distribution of albatross prey animals, such as fish  
and squid, changed due to fluctuations in ocean currents and/or  
harvest by modern merchant fisheries.

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**ELLIOTT, V. & COURTEMANCHE, M.**

*Catch of the day*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Fishing practices and species' selection by fishermen from the archaeological site, Pointe du Buisson, Station 4, are the topic of this paper. The collection of some 43,000 fish bone fragments has been analysed as the basis of a Master's thesis studying the exploitation, over an extended period of time, of the area's aquatic resources. The faunal collection is the product of fishing groups from the Late Middle Woodland period (500-1000 A.D.), in south-western Quebec, Canada. By studying the biology, ethnography, and archaeology of the site and the surrounding region, we are trying to understand the various fishing methods and exploitation of particular species by different groups over a 500 year period. Our analysis concludes that the species' selection remained relatively unchanged for the duration of the Late Middle Woodland Period in this part of the North American northeast.

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**EMERY, K.F. & STEVENS, B.**

*Animals from the Maya Underworld: Reconstructing Elite Maya Ritual, Cueva de los Quetzales, Guatemala*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** A large, well-preserved zooarchaeological assemblage has been recovered from the Cueva de los Quetzales sealed beneath a central palace complex at the Classic Maya site of Las Pacayas, Guatemala. Analysis reveals a diverse faunal population including cave residents, dietary favorites, and exotics. At issue however, is the nature of this assemblage as ritual or secular. The remains were recovered from a conical deposit immediately below the cave "chimney" opening into the center of an elite palace which effectively sealed the cave entrance and ensured elite control over this natural feature. Is this deposit the result of elite religious rituals, is it debitage from the royal dining tables, or are these bones and shells primarily the remains of natural cave fauna? The distinction is particularly important for current debates concerning the role of ritual feasting, the realities of elite subsistence, and the politics of landscape modification in the ancient Maya world.

**Keywords:** Maya, cavefauna, ritual, feasting, elite

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**ENGHOFF, I.B.**

*Of mice and men: aspects of the Norse colonisation of Greenland*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** The economy of the Norse farm "Gaarden under Sandet" in Vesterbygden, Greenland, is evaluated on the basis of excavated mammal, bird and fish bones. Changes through the period of occupation from the early phase of Norse colonisation (ca. AD 950) to the farm was abandoned (ca. AD 1350) are documented, and comparison is made with other Norse settlements in Greenland. Seals, reindeer, sheep, goat and cattle are the main contributors to the bone remains. The domestic species (sheep, goat, cattle) were represented by particularly low, stocky races. Special attention is given to bones of house mice, which seem to have been represented at the site by a particularly long-legged type known from several North Atlantic islands.

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**ENLOE, J.G. & TURNER, E.**

*Methodological problems and biases in age determinations: a view from the Late Paleolithic.*

**Session:** Ageing and Sexing

**Abstract:** Numerous methods and procedures have been proposed for the construction and of age and mortality profiles of archaeological faunal assemblages. Variations in the results and biases in the methods have great implications for the interpretation of selective strategies for hunting or for culling of domesticated herds. Taphonomic factors often bias faunal assemblages against the recognition of the youngest cohorts of archaeological populations. Paradoxically, it appears that some methods based on use wear measurements bias results in the opposite direction, either collapsing age categories of the oldest individuals or enhancing out of proportion the counts of the youngest adult individuals. This paper explores methodological considerations of dentally based age determinations. It focuses on various methods of crown height measurements, particularly comparing profiles derived from single tooth measurements with those from averaged tooth row or reconstructed individuals' dental series. Data including observations on reindeer and horse dental material from the Magdalenian sites of Verberie and Solutrø, France, are used to investigate potential variability in results and its implications for interpretations of hunting strategies in the Paleolithic.



**Keywords:** age determination, crown height, dentition, mortality, Paleolithic

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### **ERVYNCK, A. & ALEN, A.**

*The large scale and specialised Late Medieval urban craft of marrow extraction: archaeological and historical evidence from Malines (Belgium), confronted with experimental work*

**Session:** Animal Fats and Oils

**Abstract:** During recent excavations by the Institute for the Archaeological Heritage of the Flemish Community, in the late medieval town centre of Mechelen (Malines, central Belgium), a 14th century deposit was found, consisting almost solely of fragmented cattle bones. Even more unusual was the fact that 90% of the bones were skeletal elements from the cranium or the lower jaw, with a clear domination of fragments of the latter element. The more than 2000 mandible fragments studied in detail all show the same similarities: they are chopped in the region of the last premolar and first molar, and they sometimes show burning traces on the ventral side. The consistency of the treatment of the mandibles, the large number of finds, together with the highly selective nature of the assemblage, clearly points towards an industrial origin. Experimental work shows that a marrow extraction process, involving the heating of the skeletal elements, could well have produced the fragmentation and the traces observed from the finds. The hypothesis defended here is that the collection studied indeed forms the refuse of an activity fitting within a late medieval urban craft, rather than the leftovers of a household culinary preparation. A first investigation of the town's archives suggests that large scale marrow extraction can be placed into connection with the activities of one of the town's late medieval guilds: the 'vettewariers'. It is known that these craftsmen traded oils and fats but further information about the nature of their profession is virtually absent. One of the final interpretation questions thus remains unanswered: was the marrow extraction a specialised activity aiming for the production of a highly priced, exclusive product, or are we merely dealing with the marginal recycling of otherwise useless slaughter offal?

**Keywords:** late medieval period, Low Countries, urban crafts, marrow extraction, experimental archaeology

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### **ERVYNCK, A.**

*Orant, pignant, laborant. The diet of the three orders within the feudal society of medieval Europe.*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** 'On earth, there are people who pray, people who fight and people who work. These three groups form a unity and do not tolerate separation'. This statement, written down explicitly for the first time in the 11th century, describes the essence of the European feudal society. The self-image of a society consisting of a divinely created trinity of orders was only abandoned during the French revolution, and thus dominated European social history for almost a millennium. In a world of priests, knights and peasants, the three orders distinguished themselves by a different social behaviour, not only based on their specific economic position, but also upon ideology. As part of their characteristic behaviour, the three orders also ate differently. Indeed, the differences between the diet within a castle, an abbey or another household, are not the result of culinary preferences; they are a reflection of the position within society. This pattern can easily be illustrated, and explained, by a survey of zooarchaeological data from medieval and post-medieval sites from Flanders, Belgium.

**Keywords:** Middle Ages, Europe, feudalism, social identity, food patterns

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### **ESCALERA, J. E. & BALLBÈ, E.G.**

*Last Foragers in Coastal Environments: a Comparative Study of Cantabrian Mesolithic, the Yámana of Tierra del Fuego and Archaic Foragers in Central America Coasts*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Coastal foragers have been a recurrent topic in last years and object of many explicative models. Generally have emphasise a conception of "affluent foragers" encouraged by abundant and attractive littoral resources. An alternative vision has argued that processes, which have allowed these groups to colonise the coast and consuming their resources, were an intensification process caused by demographic pressure and by a decrease of terrestrial collecting and hunting productivity. In this paper we present the results of many years of archaeozoological

and ethnoarchaeological research in three different contexts where foragers societies exploited littoral and marine fauna in different degree. The analysis of food production through vertebrate and invertebrate fauna consumption has allowed us evaluating economical basis of these societies. Likewise, the comparative study of three different geographical situations has permitted us to discard strict ambiental causalities. Consequently, more complex explicative models can be proposed considering economical and social characteristics of these groups. We also tackle the discussion about the problem of their evolutionary change to domestication economies when this succeeded.

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### ESTÉVEZ, J.

*Vanishing carnivores: on the trail of lost European Pleistocene carnivores.*

**Session:** Neanderthal ecology

**Abstract:** During the Middle-Upper Palaeolithic transition large European Pleistocene carnivores began to vanish. This event was not synchronous over all Europe but had a west-east chronological gradient. Dates and data from the Iberian Peninsula are contrasted with data from Central Europe. This information, in turn, is correlated with the archaeological evidence and palaeolithic rock and mobile art. Several hypotheses are suggested to explain the data trends and a new, possibly coordinated research line is proposed.

**Keywords:** carnivores, Pleistocene extinction, cave art.

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**EVERSHED, R.P., BERSTAN, R.,  
DUDD, S.N., COPLEY, M.S. &  
MORGAN, E.D.**

*Chemical Characterisation of 'Bog Butter' using a Combination of Molecular and Isotopic Techniques*

**Session:** Animal Fats and Oils

**Abstract:** Historical records of the numerous discoveries in the peat bogs of Europe (mainly Scotland and Ireland), of the so-called "bog butters" serve only to add to the confusion surrounding the precise origin of these sometimes very substantial hoards (as much as 50 kिलograms buried in wooden

containers) of ancient fats (dating at least to *ca.* 1700 years BP). Circumstantial evidence of their origin comes from the presence of cow hair, while documentary sources, for example Butler's *Hudibras*, written in the seventeenth century, includes the remark "Butter to eat with their hog, was seven years buried in a bog", which appears to leave little doubt as to the precise origin of "bog butter". Significantly, chemical analyses performed over the last nearly one hundred years have been unsuccessful in confirming whether "bog butters" are truly butter, or some other type of diagenetically transformed fat. Analyses have shown all "bog butters" are very similar in composition, being largely hydrolysed to free fatty acids, that oleic acid is present in low abundance and hydroxy acids are present in significant proportions (up to 15% w/w). The major conclusion from these analyses is that "bog butters" resemble adipocere (decomposed adipose fat) more closely than, butter thereby appearing to contradict historical records. Our recent work on dairy fats associated with archaeological pottery has shown that the triacylglycerols of milk are rapidly transformed during burial into a distribution more closely resembling adipose fat and butter. This occurs via preferential hydrolysis of the short-chain acyl moieties as a result of reduced steric effects at ester linkages in triacylglycerols compared with those bearing long-chain fatty acyl moieties. Once released the short-chain fatty acids are appreciably more water soluble than their long-chain counterparts and are leached in waterlogged environments. In the case of butter buried in a bog this process would be expected to yield a "bog butter" displaying a fatty acid composition more reminiscent of degraded adipose fat than butter. Examination of a number samples of "butter bog" recovered from various locations in Scotland and Ireland using and combination of analytical chemical techniques, including gas chromatography-combustion-isotope ratio mass spectrometry, has provided  $\delta^{13}\text{C}$  values for the palmitic (C16:0) and stearic (C18:0) acid components. Plotting these  $\delta^{13}\text{C}$  values with those of the same fatty acids from a range of reference animal fats, sampled from domesticated animals (cattle, sheep and pigs) raised on known C3 diets, shows the "bog butters" to fall into two distinct groups, i.e. those that are *true* butters or milk fats and those derived from ruminant adipose fat. The ability to distinguish between adipose fats and butter fat on the basis of stable carbon isotope values of individual fatty acids rests on the fundamental difference in the  $\delta^{13}\text{C}$  values of their dietary (plant) fatty acids and carbohydrates ( $\delta^{13}\text{C}$ fatty acid-carbohydrates *ca.* 5-10‰) and the different ways in which these components are routed and metabolised during milk and adipose fat synthesis. Hence, this compound specific stable isotope method of distinguishing between ancient fats has finally resolved the question of the origins of the enigmatic "bog butters".

**Keywords:** bog butter, stable isotopes, adipose fat, milk fat, ruminants

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**EVERSHED, R.P., COPLEY, M.S.,  
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DOCHERTY, G., STRAKER, V. &  
PAYNE, S.**

*Evidence for Widespread Dairying in Prehistoric Britain*

**Session:** Milk, Milking and Dairying

**Abstract:** Information relating to dairying in prehistory period is limited largely to secondary evidence, e.g. vessels presumed to be associated with the procurement and utilisation of dairy products, such as putative ceramic 'cheese' strainers (Sherratt, 1981) and faunal assemblages in which a high neonatal cull and a bias in the adult cull in domestic ruminant animals has been taken to indicate a dairying economy (Legge, 1981). Since these indicators remain unproven, a preferred approach to detecting dairying would be through the identification of preserved residues of dairy products themselves, e.g. remnant milk fats in archaeological pottery. Our recent research has shown that distinctions can be drawn between degraded dairy and adipose fats preserved in archaeological pottery based upon measurements of the stable carbon isotope ratios ( $\delta^{13}\text{C}$  values) of individual fatty acid components. Most importantly, we have observed that dairy fats exhibit more depleted  $\delta^{13}\text{C}$  values for the C18:0 fatty acid compared with the adipose fats of animals raised on the same diets (Dudd and Evershed, 1998). The isotopic differences observed relate to the fundamental differences between the  $\delta^{13}\text{C}$  values of lipids and carbohydrates in plants, together with variations in carbon routing and energy balance in the bodies of ruminant animals during adipose and milk fat synthesis. These conclusions, and the wider application of this approach to the study of ancient dairying in prehistoric Britain, are supported by compound specific  $\delta^{13}\text{C}$  analyses of the carbohydrate and fatty acid components of a wide range of plant species likely to have comprised the diets of ruminant animals foraging in prehistoric landscapes. Application of compound specific  $\delta^{13}\text{C}$  analyses to the study of animal fat residues from potsherds sampled from a large number of prehistoric sites located in southern Britain shows that dairying was a widespread activity detectable with high frequency amongst early Neolithic communities. Compound specific radiocarbon dating of fatty acids from a variety of pottery have provided us with direct dates for early Neolithic dairying products in Britain.

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**FABIŠ, M.**

*Cattle back bone alteration – evidence for draught exploitation?*

**Session:** Beyond 'interesting specimens':

palaeopathology and its contribution to the study of animal husbandry

**Abstract:** Archaeological excavation of an Eneolithic site in Svodin (south-western Slovakia), carried out by V. Nemejcová-Pavúková of the Archaeological Institute of the Slovak Academy of Sciences in Nitra between 1971-1983, provided lot of archaeofaunal remains. An interesting part of the remains were the skeletal remains of cattle found in a series of separate burials. The burials were dated to period of the Baden culture. Feature No. 328/74 contained skeletal remains of two individuals. One of the skeletons showed severe alteration of the backbone. Joint surfaces of the elements which formed the lumbo-sacral conjunction (last lumbar vertebra and cranial segment of sacrum) show changes typical for arthrosis – strong pitting of the subchondral compact bone, loci of eburnation, and exostoses around the edge of the joint surface. Additionally, anomaly in morphology of lumbar vertebrae of the next animal was recognized. The horizontal plane of both processus costarii (transverse processes) is physiologically more or less perpendicular to the sagittal plane of vertebral body. However, this is not the case of lumbar vertebrae discussed in this paper. The horizontal line of the processus costarii is turned in approximately  $15^{\circ}$  (upward on the left and downward on the right side of the vertebral bodies). There is a strong suggestion that the described changes of the spine elements could have resulted from the use of the cattle as draught animals. Judging from the context in which the material was found and the described skeletal changes it seems that the burial contained remains of draught animals working in pair.

**Keywords:** Cattle, draught exploitation, vertebrae, Eneolithic, Slovakia

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**FABIS, M., MIKLIKOVÁ, Z. & MULLER, M.**

**Poster:** *Evidence for the cattle horn core handicraft in Nitra (11th-13th and 16th-18th centuries A.D.)*

**Session:** General

**Abstract:** An archaeological excavation carried out in the year 2000 at the open market place in central part of Nitra/Slovakia (11th-13th and 16th-18th centuries A.D.) resulted in accumulation of 3025 (46,478.2 g) samples of archaeofaunal remains. The remains consist almost exclusively of skeletal elements of domestic animals with high dominance of cattle (43.4 %). Rather exciting were numerous finds of cattle horn cores, many of which with traces of sawing and cutting. Identified intentional traces indicate that the horn cores are remains of horn handicraft/manufacture producing horn items like combs, buttons, etc. Number of the horn cores were preserved complete or almost complete. Judging from the size, shape and conformation of the 16th-18th centuries A.D. horn cores, following breeds were identified: Hungarian Grey; Carpathian Grey, and Simmental cattle. The 11th-13th centuries A.D. horn core remains remind small cattle of brachyceros type, similar to the cattle we know from other early Middle Ages sites in Central Europe.

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**FACCIOLO, A. & TAGLIACOZZO, A.**

**Poster:** *Paleovenetian animal burials from Padova, Via Santa Eufemia (VIII-VII Century B.C.)*

**Session:** General

**Abstract:** The results of the study carried out on some ritual burials recovered in the archaeological site of S. Eufemia, Padova, are presented. The area presents a complex sequence of activities and appears to have been used mainly for ritual aims. The most ancient presence, which can be ascribed to the end of IX - beginning of VIII century B.C., returned a set of little 'pits' containing unburnt animal bones and burnt very small bone fragments. These structures have been interpreted as offerings for the dead of the nearby necropolis. After this starting phase, the site was involved in more consistent activities, represented by the creation of graves with more common features, aimed at the deposition of human and animal remains. These structures have been linked to a final moment in the VIII - beginning of VII century B.C. Afterward the area was involved in further activities, at first it was used as a cremation centre, related to the nearby necropolis in Via S. Massimo. Then, between the VI and

V century B.C., the surface was occupied by a funeral tumulus with a small convexity, hosting a relevant number of tombs. Leaved in the V century B.C., only with the Roman phase, in the I century B.C., humane activity begins again. The 'ritual graves' constitute the phase richest in data. These were all made as rectangular graves, varying in dimensions, their early use was the combustion of a relevant amount of wood. The grave installation and the fires are only the first part of a more complex ritual carried out over an extended period of time. In fact, all the structures appear to be excavated more than once to bury animal and human remains with a predetermined succession of depositions. In this work some structures are presented. In three of these structures have been recovered some horses. These animals were deposited in correct anatomical position with scattered bones of dog. In another structure several dogs were buried together with a human deposition.

**Keywords:** Ritual burials, horse, dog, Paleovenitians, Iron Age.

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**FERNANDEZ, H., LUIKART, G. & TABERLET, P.**

*Assessing the origin and diffusion of domestic goats (Capra hircus) using ancient DNA*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Studies of ancient DNA are becoming more feasible and can potentially facilitate our understanding of the origin and diffusion of domestic species. Our previous studies in goats characterized modern DNA sequences (control region of mitochondrial (mt) DNA); these studies revealed three well distinct mitochondrial lineage, suggesting three maternal origins of goats. These lineage were nevertheless widespread geographically and showed weak genetic structure, suggesting extensive movements at the intercontinental scale (although one lineage appeared restricted to Eastern Asia). Our ongoing analysis of the ancient DNA polymorphism (from fossil bones), based on mitochondrial sequences (130-360 bp of control region), should help clarify the origin and spread of the different lineage across the Old World. We have thus far recovered mtDNA from 20 ancient samples dating from ca 7000 to 1000 years ago, from sites in Europe and Middle-East. Interestingly, these preliminary results reveal the presence of two of the three lineages in a single site in Southern France dating from the very beginning of the Neolithic period. This is consistent with a diverse goat gene pool, possibly with multiple geographic sources, from the very beginning of the diffusion of livestock into Europe. We are currently extending this study to include more sites, as well as the wild progenitors (*C. aegagrus*, *C. falconeri*?) of domestic goats from across Eurasia.

**Keywords:** ancient DNA, goat domestication, genetic diversity, mitochondrial lineages.

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### FIELD J., BROWN O. & LETNIC M.

**Poster:** *Know the scavengers and their season: field experiments in scavenger related taphonomy at Cuddie Springs, Australia*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** The greatest problem with understanding the effects that scavengers have as removers of bone from potential archaeological deposits is the difficulty that we have in quantifying that removal. Field experiments conducted at Cuddie Springs, a semi-arid sub-tropical inland site in Australia, have been conducted over several years aimed at investigating scavenger removal rates and their seasonal variation. Results have indicated that the scavenging activity of most important removal agents can be predicted according to definable seasonal factors. For example, prolonged periods of increased rainfall lead to increases in edible vegetation for pigs, a consequent increase in their population numbers, and then dramatically increased carrion scavenging by pigs following a subsequent period of lower rainfall. Also, the activity of other scavengers can be predicted according to more explicit seasonal factors (eg., seasonal nomadism of Black Kites [*Milvus migrans*] or winter dormancy of monitor lizards [*Varanus* spp.]). Given the evidence available for most archaeological sites on environmental conditions around the time of assemblage formation, and the species of scavengers likely to be present, we believe that a reasonable measure of potential bone removal by scavengers can be determined.

**Keywords:** Taphonomy, scavengers, Cuddie Springs.

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### FIORE I., GALA M. & TAGLIACCOZZO A.

*Ecology and subsistence strategies in the eastern Italian Alps during the Middle Paleolithic*

**Session:** Neanderthal ecology

**Abstract:** Italy is very rich in Middle Paleolithic sites and the Veneto region ranges among those with the best archaeozoological information. Most of the Middle palaeolithic sites are located in caves and rockshelters located at the mouth of the Alps valleys, in the pedemontan slopes. The two sites that granted the best archaeozoological data are Riparo di Fumane and Grotta S. Bernardino. Grotta S. Bernardino was occupied alternatively by humans and carnivores, in particular bear. The fauna is largely dominated by ungulate remains with red and roe deer prevalent over chamois and ibex; elk and giant deer are also present. Among the carnivores, the most frequent species is cave bear followed by linx and leopard. Furthermore, hare, beaver and marmot are present together with remains of both fish and birds. It is possible that the rare fish remains were introduced by bear or birds of prey. In the Mousterian levels hunting of the most common species was mainly monitored towards young-adult and adult individuals, suggesting the possibility of selective hunting. Marmot, beaver and probably bear, together with some species of birds (ducks, geese and galliformes) were also hunted. At Riparo di Fumane Mustertian and Aurignatian levels were excavated. The taphonomic analysis evidenced traces of human activity related to carcass processing and bone exploitation. The most frequent ungulates are red deer, followed by roe deer and ibex; less frequent are chamois, bovids and *Megaloceros giganteus*. Among the carnivores, both *Ursus arctos* and *Ursus speleus* are present, with wolf, red fox and *Crocota crocuta*. Furthermore, hare and marmot are present together with abundant remains of birds. The most common species are: *Lyururus tetricus*, *Crex crex* and *Pirrococorax graculus*. Mortality data of ungulates suggest that young adults and adults were preferentially selected. Such a faunal assemblage indicates that economic, ecological and climatic changes were taking place between the Mousterian and the Aurignatian levels.

**Keywords:** Italy, hunting, birds, climatic changes, carcass processing.

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### FORONOVA, I.V.

**Poster:** *Late Quaternary Equidae of Western Siberia*

**Session:** Equids in Time and Space

**Abstract:** Western Siberia, a vast plain stretching for more than 2,000 km from North to South, is part of large Siberian sub-continent. Thick Quaternary deposits containing rich paleontological material mainly occur in the Southern part. The main fossil locality is Kuznetsk Basin (largest in Northern Asia). The author has traced there an almost continuous succession of mammal faunal complexes in the interval of 1,8-0,01 m.y.

Equidae is the predominant group (50%) in all stratigraphical horizons. Statistical analysis of morphometric features of cheek teeth and limb bones revealed representatives of various phyletic lineages of horses, the evolution of which was determined by environmental conditions. Caballoid horses predominated at every stratigraphic stage. In the Late Pleistocene the territory was inhabited by rather small forms, retaining typical morphological features and proportions of their ancestors. Beginning from the last interstadial (50 th.y.) a small wide-hooved caballoid horse was the most widespread. Morphology and proportions imply a humid environment and point to its similarity with *E. caballus latipes* and *E. gallicus* of Late Pleistocene and the wide-hooved Middle Pleistocene *E. cf. mosbachensis*. The tarpan *E. gmelini* may have been part of this group. Another caballoid horse was adapted to an arid environment. It had hypodont molars and gracile metapodials almost identical with *E. przewalskii*. It resembles *E. taubachensis* and perhaps a peculiar caballoid form established here at the Early Pleistocene. Probably the natural habitat of the Przewalski horse covered not only the spaces of Central Asia but stretched also to the North from the Mongolian Altai to the steppes and forest-steppes of Southern Siberia. Part of the material from the latest Pleistocene is of unclear systematic affiliation and requires further analysis. By some features these fossils somewhat resemble kulans and donkeys, but differ by a larger size. Existence of genuine donkeys on the territory is questionable, while kulans could be spreading from China, Mongolia and Kazakhstan to the steppe zone of Southern Siberia.

**Keywords:** Western Siberia, Pleistocene, Equidae, morphometric features

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#### **FORSTENPOINTNER, G. & WEISSENGRUBER, G.**

*Patterns of animal sacrifice at the Archaic Artemision of Ephesos – investigations in the significance of archaeozoological findings*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Faunal remains from the archaic Artemision at Ephesos are characterized by significant conditions of finding; distinctly marked agglomerations of “sacrificial waste“ are amalgamated with ashes, sherds of pottery and even precious votives, such as figurines worked of gold, ivory or amber. Archaeozoological analysis of sacrificial deposits displays a striking variety of selective patterns, most of them illustrating well-known traditions of ancient Greek religious traditions. Corresponding to discernible quantities of findings three different categories of residuals prove not only outstanding importance but also specific groups of worshippers:

-Burnt faunal remains show a striking predominance of carbonized or calcined fragments of thigh bones and patellae of small ruminants. A smaller group of burnt residuals is represented by bovine sacral and caudal vertebrae. According to literary evidence both findings suggest an interpretation as remains of the ritual procedure of P\_Ū\_ (Thysía). Being a most common feature of Greek religious activities this tradition cannot be assigned to the worship of specific deities but rather displays a politically effective ceremony of public offering.

- High percentages of infantile pig bones found in archaeological context with lamps and typical water jars suggest an assignment to certain religious ceremonies corresponding to the worship of Demeter and Kore. Above all the strictly feministic and hidden rite of thesmophoria, dealing with the offering suckling piglets, indicates therefore a strong connexion of Artemis Ephesia with Demeter in archaic era.

- Large quantities of horn-cores, mostly proving the offering of female goats, have been deposited as a whole horn-bearing calvariae. So-called horn altars (JaTWZ RMYD\QUWZ) prove literary evidence from Delos and archaeological verification from Dreros (Crete), always indicating worship of the Letoadic twins, Apollon and Artemis. Additionally an older layer of archaeological evidence assigns goat horns as important ritual objects in Minoan Crete.

**Keywords:** Ephesos, sacrifice, burnt offering, goat horns, piglets

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#### **FOSSE, P.**

*New information on non-anthropogenic bone accumulations from excavations and actualistic studies*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** In recent years, reconstruction of human subsistence strategies have become integrated into a global taphonomic history in which non-anthropogenic bone producing/modifying agents have specific importance. As numerous (pre)historic sites yield both human and non-human bone accumulations, distinction between agents of bone modification and the characterization of each agent of intervention is of the greatest interest for Old and New World (zoo)archaeology. Although research on this topic has been undertaken for more than a century, qualitative and quantitative characterization of accumulations/modifications from both biological agents (carnivores, birds of prey, (large) rodents etc.) and non-biological ones (climatic, edaphic and diagenetic agents etc.) still need to be undertaken. This is due to the mutual relationships between them both in time (synchronic vs diachronic bone discard) and space (inter-site vs intra-site usage). This paper presents the results of current research on a range of modern and fossil carnivore assemblages derived from recent excavations or

actualistic experiments from locations in France and elsewhere in Europe.

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#### **FRADKIN, A.**

*Snake consumption among early inhabitants of the 'River of Grass', South Florida, USA*

**Session:** General

**Abstract:** A vast open expanse of grassy marsh, the Everglades, or 'River of Grass', was the home of indigenous populations for several thousand years. The use of snakes as a dietary resource by these early inhabitants is investigated. Animal remains from three precolumbian sites, ranging in time from the Late Archaic (ca. 1000 BC) through the Glades (AD 500-1500) cultural periods, are examined. All three sites are black dirt middens located on tree islands in the eastern half of the Everglades. Snake remains constituted a significant portion of the faunal assemblages, contributing approximately 20 to 40 percent of the edible meat weight represented. That a substantial quantity of snake bones were recovered in midden contexts in association with other subsistence remains strongly indicates that such animals were intentionally procured, presumably for food, and were part of the diet of early Everglades people. Finally, several ethnohistorical sources documenting the consumption of snakes among Florida indigenous people are discussed.

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#### **FRAZIER, J.**

*Marine turtles of the past: a vision of the future?*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Marine turtles, as charismatic "flagship" species, attract extraordinary attention, from diverse sectors of society - from scientific to political. Their remains - large robust, and distinctive - are potentially ideal for archaeozoology. Moreover, cultural and historical evidence of human-turtle interactions is diverse, and often highly illuminating. These reptiles have been exploited by diverse societies, for varied reasons, since before the dawn of civilization, figuring as major items of subsistence and trade in past ages. Yet, the archaeological record is patchy at best, with apparent anomalous gaps in occurrence and other basic information from sites that "should" provide extensive material. "Schleping" may explain part - but not all- of the enigma, and other factors need to be considered, beginning with problems in methodology (e.g., sampling, collecting, cataloguing, and reporting). Climate/environmental change as well as human and/or turtle population changes may also be relevant, and hence highly germane to contemporary society. However, confusion in biological terms and concepts, as well as mis-reporting,

complicate simple, defensible interpretations of the data. The "turtle story" provides a potentially attractive window to the future, but to be effective we need to improve various aspects of the scientific work.

**Keywords:** biological conservation, marine turtle, data, interpretation, methods

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#### **FREY, C.J. & NILSSEN, P.**

*Zooarchaeology and wildlife: Metric discrimination of two morphologically similar South African bovids*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Zooarchaeologists possess a range of tools with untapped utility for conservation biology and wildlife management. This study explores the use of metric species determinations for two congeneric, small-bodied browsers. Steenbok (*Raphicerus campestris*) and Cape Grysbok (*Raphicerus melanotis*) have overlapping ranges in the fynbos regions of South Africa, but the two species have divergent ecological tolerances, and are subject to somewhat different hunting regulations. While skeletal remains of the two species can be distinguished from one another on the basis of discrete cranial characteristics (Klein 1976), their postcrania are generally considered unassignable at the species level. This means that partial skeletons, isolated elements and most archaeological remains are not assignable beyond the genus level. Bivariate and multivariate analysis of measurements taken on limb bones (adult femora, humeri and metapodials of museum specimens show that at least some skeletal elements are clearly identifiable to species at a high level of confidence. Because skeletal remains are generally received in fragmented form, we emphasized measurements taken on portions likely to survive and therefore more likely to be measurable on field or archaeological specimens. That selected skeletal elements of these taxa can be identified to species opens the possibility of increasing our understanding of the biogeographic history of these animals, and also provides a forensic tool relevant to wildlife management.

Klein, Richard G. (1976). The fossil history of *Raphicerus* H. Smith, 1827 (Bovidae, Mammalia) in the Cape Biotic Zone. *Annals of the South African Museum* 71:169-191.

**Keywords:** metrics, bovids, *Raphicerus* spp., conservation, South Africa

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### FRIESEN, T.M. & BETTS, M.W.

*Archaeofaunas and architecture: zooarchaeological variability within an Inuit semi-subterranean house, Arctic Canada*

**Session:** Integrating Zooarchaeology

**Abstract:** Across the North American Arctic, many ethnographically described Inuit groups lived in substantial semi-subterranean houses during the winter. While these houses are among the most common contexts excavated by arctic archaeologists, the activities carried out in what are assumed to be functionally different parts of the houses are not fully understood. In this paper, we will interpret the abundant and well-preserved faunal samples from a complex pre-contact semi-subterranean house at the Cache Point site, Mackenzie River Delta, northwestern-most Canada. This site was occupied about 700 years ago by Inuit who relied on beluga whales for a large proportion of their diet, but who also acquired a wide variety of fish, bird, and terrestrial mammal species. Within this house, at least six areas can be differentiated: the rear bench, floor, “kitchen” alcove, entrance tunnel, midden, and storage cache. Ultimately, zooarchaeological data in the form of species frequencies, element distributions, and bone modification in each of these contexts will be used to test the validity of ethnographically derived models of Inuit household organization, as manifested in house architecture.

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### GAL, E.

*Bird remains from two Romanian caves: Curata Cave (Nandru) and Bordu Mare Cave (Ohaba Ponor)*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** Curata Cave was occupied by humans as early as the Middle Palaeolithic (Mousterian I), but chalk materials from Neolithic (Cris/Körös Culture), Bronze (Cotofeni Culture) and Medieval occupation layers also were found in the cave. The majority of bird remains were excavated from Mousterian levels and the next 20 species were identified: *Anas penelope*, *A. platyrhynchos*, *Aythya nyroca*, *Pernis apivorus*, *Haliaeetus albicilla*, *Aegypius monachus*, *Buteo lagopus*, *Aquila clanga*, *Falco tinnunculus*, *Tetrao tetrrix*, *T. urogallus*, *Perdix perdix*, *Crex crex*, *Strix nebulosa*, *Asio flammeus*, *Picus canus*, *Turdus pilaris*, *Pyrrhonorax graculus*, *Corvus monedula* and *Sturnus vulgaris*. Black Grouse (*Tetrao tetrrix*) is represented by a

significant number (63) of bones contrary to other species that present only 1-8 remains. Further 8 species - *Anas cf. clypeata*, *Haliaeetus albicilla*, *Circus cf. macrourus*, *Tetrao urogallus*, *Strix aluco*, *Asio flammeus*, *Pyrrhonorax graculus* and *Corvus corax* - were identified from the younger levels of this cave. The oldest bird remains from Bordu Mare Cave came from Mousterian III-IV levels and provided the next species: *Haliaeetus albicilla*, *Gypaetus barbatus*, *Falco vespertinus*, *Lagopus cf. mutus*, *Perdix perdix*, *Gallus gallus*, *Turdus merula*, *T. viscivorus*, *T. pilaris*, *Pyrrhonorax graculus*, *Corvus monedula*, *C. corone*, *Fringilla montifringilla*, *Carduelis chloris* and *Coccothraustes coccothraustes*. Younger (Aurignacien?) levels yielded *Plegadis falcinellus*, *Anas platyrhynchos*, *Gypaetus barbatus*, *Falco sp.*, *Lagopus mutus*, *Perdix perdix*, *Gallus gallus*, *Scolopax rusticola*, *Tringa totanus*, *Hirundo rustica*, *Turdus pilaris*, *Garrulus glandarius*, *Pica pica*, *Corvus monedula* and *C. corax*. The high diversity of the species, the low number of remains and the large time span they were gathered in, permit the conclusion that the majority of bones come from owl pellets.

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### GALIK, A. & KUNST, G.K.

*Dietary habits of monastic communities as indicated by animal bone remains from Early Modern Age in Austria.*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Rescue excavations in the former Carthusian monastery of Mauerbach (Lower Austria) provide the rare opportunity to study the food remains of a distinct group of people with special dietary habits. The Carthusian monks were expected to abstain entirely from meat of “warm blooded” animals. As a consequence, many bone samples retrieved from the convent are dominated by remains of fish and of other aquatic species regarded as a substitute for fish, like turtles, beavers, waterfowl and marine molluscs. According to historical sources, the supply of animals was organized through foreign trade, urban markets and local production, which was at least attempted in the case of turtles. The relevance of the aforementioned animal groups for the monks’ social identity is likewise expressed by figural art and the presence of a “tortoise garden”. The studied material was derived from various archaeological contexts, which accumulated within and outside buildings. Most of the bone accumulations relate to a rebuilding phase of the monastery, taking place in the first half of the 17th century A.D. This period corresponds to the so-called Counter Reformation, a stage of major political reconstruction characterized by enormous building activities all over the Hapsburg empire. These very specific animal assemblages of the Carthusian monastery are compared to remains of the following either contextually or chronologically corresponding Austrian sites:

- Tulln (Lower Austria), Dominican convent, Late Medieval;
- Neuberg (Styria), Cistercian monastery (16th-18th century);
- Khuenburg palace (Styria), former convent, secularized in the Early Modern Age;



- Alte Aula (Vienna), the old university under Jesuitic administration, 1st half of 17th century.

Though generally being of less importance than in Mauerbach, the role of species taken for "Lenten diet" is obvious in all compared sites. Until the 19th century the spreading of special food habits (e.g. turtles, beavers) beyond monastic communities into ordinary Viennese households is documented by historical sources.

**Keywords:** diet, monastery, economy, turtles, fishes

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### **GALIK, A.**

*An Iron Age bone assemblage recovered inside the vertical cave, Durezza in Carinthia, Austria - how significant are archaeozoological and taphonomical analysis to detect ritual behavior?*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Dwells, pits, postholes and natural cavities attracted people to dump "special depositions," especially during prehistoric times in Central Europe. These subsoil features often revealed human and animal remains associated with metal work and pottery. The following presentation aims, to discuss results obtained from finds in Durezza cave. I address the results to a comparative and synthetic discussion about the use of such specific sites. Human input into Durezza cave was originally explained as a form of regular burial. Though a considerable lack of common additions (ornaments and pottery) is obvious. Following an anthropological interpretation, the animal remains might represent either additions given to dead people, or simply remains of habitual and mundane actions. However, before discussing questions of mundane or ritual behavior an extensive taphonomical investigation is required. Therefore, numerous detailed examinations were undertaken to determine the potential of animal remains to distinguish between material from domestic and ritual activities. In the Durezza cave complex carcasses appeared, including complete skulls and articulating body parts. The species assemblage shows a typical composition, which is usually considered "special deposition." Dog remains are definitely most frequent. Other domestic animals, such as horse, caprines or cattle seem to be less important. Although, few bones show cut marks or green bone fractures, these modifications give evidence for the butchering or dismemberment of individuals. This assemblage reveals a distinct category of "special depositions" that differs from daily waste deposits. The depositions continued over a longer period of time and repetitive characters are found in mortality patterns. Therefore, the animal

bones of Durezza can be interpreted as remains of distinct practices. Important questions arise. How are animal deposits related to the human "burials"? In a broader sense, why do people deposit humans and animals into cavities? Do similar patterns indicate similar practices throughout contemporaneous cave sites?

**Keywords:** Iron Age, Carinthia, cave fauna, Austria, ritual behavior

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### **GASSIOT, E.**

*Shellmiddens in the Caribbean Coast of Nicaragua: prehistoric patterns of molluscs collecting and consumption.*

**Session:** Archaeo-Malacology

**Abstract:** Since 1997 more than seventy-five shellmiddens have been detected during different surface field-works in a littoral strip of about 50 Kilometres of the Caribbean Coast of Nicaragua. Sixteen <sup>14</sup>C dates define a relatively continuous sequence for this kind of site, from 1400 cal BC to present. In all of them only one bivalve species predominates, representing more than 90 % of the volume of the archaeological deposits. In most shellmiddens the more frequent species is the local clam *Polymesoda solida*. Other dominant bivalves present in some sites are *Donax* sp. and *Crassostrea rizophorae*. In this paper we undertake through archaeological data, the different characteristics of the *Polymesoda* sp. and *Donax* sp. exploitation. The first case presents evidences of overexploitation of *Polymesoda* sp. in prehistoric times and collection was individual, which means one by one. The biometric characteristics of the *Donax* sp. specimens allow us to infer a mass collecting pattern, which is analogous to the actual. On the other hand, the different stratification processes also show different consumption patterns, probably stational in the case of *Donax* sp.

**Keywords:** Shellmiddens, collecting pattern, consumption pattern, Caribbean, Palaeoeconomy

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### **GAUDZINSKI, S.**

*Late Middle Palaeolithic subsistence behaviour during the Eemian Interglacial (OIS 5e) in Northern Europe*

**Session:** Neanderthal ecology

**Abstract:** The paper presents main data on records attributed to the short phase of the Eemian Interglacial (OIS 5e) in Northern Europe. Behavioural implications of the presented data are debated in the context of our current knowledge on Middle Palaeolithic subsistence. It is discussed whether a dependant relationship between hominid subsistence tactics and the environmental context is evident.

**Keywords:** Northern Europe, Late Middle Palaeolithic, Eemian Interglacial (OIS 5e), Neanderthal subsistence behaviour

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### GEIGL, E.-M.

*Evidences for DNA preservation in Lower Palaeolithic fossils*

**Session:** Taphonomy

**Abstract:** The discovery, in the late 80ies, that DNA is sometimes preserved in fossils opened up a new field of investigations, which has the potential to contribute in a significant manner to archaeology, archaeozoology, palaeontology, population genetics and molecular evolution. The enormous technical difficulties that the newborn field of palaeogenetics encountered over the last 15 years has so far limited the importance of its contributions. These technical difficulties are the consequences of the matter of analysis itself, i.e., DNA, which is fragmented, chemically modified, and bound to the mineral matrix of the fossils where it is preserved. One key problem with current palaeogenetic approaches is that the methods used to extract, purify and PCR amplify DNA traces are those developed for biological material, i.e., fresh tissue, whereas palaeogenetic studies require extraction and purification of DNA out of geological specimens, i.e., fossils. Using a different molecular biology method allowing detection of DNA in a sequence-specific manner without purification, I could show that DNA can resist total degradation and escape fossilisation over a much longer time than previously thought. This DNA seems to be preserved in "molecular niches" in an insoluble form thanks to complexation with the mineral matrix and/or the insoluble macromolecular sedimentary organic matter. In order to understand the taphonomical factors leading to DNA preservation and to develop new extraction and analysis methods that are adapted to the particular DNA chemistry in a geological context. I am now aiming at understanding, via a multidisciplinary approach, if and how different components of the macromolecular sedimentary organic matter are preserved in these fossils. Here, I will discuss the different taphonomical conditions that might have caused DNA preservation in the faunal remains of a Lower Palaeolithic site in Brittany (Menez-Dregan).

**Keywords:** biomolecules, DNA, bone mineral

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### GERMONPRÉ, M.

*The influence of climate on cub mortality and sexual segregation in Pleniglacial cave bear*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Several horizons from the cave of Goyet, Belgium, yielded Pleniglacial cave bear remains. The cave has an interesting ecological position, 15 m above the river. Cave bear assemblage A1 dates from the Hengelo interstadial (38.8 K), assemblage B4 from the more severe Huneborg interval (35.5 K), assemblage A3 was not dated. 60% of the remains from assemblages A3 and A1 is from females; 67% in assemblage B4 is from males. In assemblages A1 and A3, 33% of the canines is from very old males, based on extensive wear. In assemblage B4, the frequency of very old male canines is 10%. The harsher circumstances during the Huneborg limited the life span of the bears, and promoted hostility among males, succumbing at a younger age than those from assemblages A3 and A1. The scarcity of very old males in B4 permitted the immigration of young aggressive males, which induced the female bears to leave the valley. The winter rest of the female bears, including the transition after den emergence but before abandoning of the den area, took 5.5 months for assemblage A3, and 8.5 months for assemblage B4, based on the age of the first-year cubs at the end of the dormancy. The minimal mortality rate of the first-year cubs in A3, A1 and B4, from birth until abandoning of the den area, is respectively 5%, 7.7% and 18%. The ecological and climatic conditions influenced the mortality rate of the cubs. A higher rate was the consequence of an exhausted mother which after a long winter, could not feed well her young, nor defend them against carnivores, including male bears, pointing to a severe climate like during the Huneborg. A lower mortality rate implies a stronger mother after a shorter winter rest, and a milder climate as during the Hengelo.

**Keywords:** Ursus, cub mortality, sexual segregation, climate, pleniglacial

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### GIDNEY, L.

*"Reare the Goose". Recognition of a standard method of carcase dismemberment*

**Session:** General

**Abstract:** The role of the carver at table has always been of importance in acknowledging the relative status of the diners by the portions allocated. Our modern methods of carving are

rooted in the nineteenth century, with such detailed instructions as those provided Mrs Beeton's *Book of Cookery and Household Management*. Interest in this topic was stimulated by the realisation that the goose sternum, in particular, on a variety of Medieval and Post-Medieval sites had been dismembered in a prescribed manner that is unlike our present conception of how a goose should be served. The find of all the adjoining sternum fragments and associated limb bones from an excavation in Berwick prompted further investigation of the historical documentation for the serving of goose. A facsimile printing of the 1638 edition of John Murrel's *Two Books of Cookerie and Carving* provided detailed instructions on how to "Reare the Goose", producing cuts identical to the archaeological finds. To test the accuracy of the method, a goose was roasted and carved according to the instructions given. The resulting bones are not as close to the archaeological specimens as anticipated. The Medieval carver did not have a carving fork to assist in the operation. This is the critical difference between ancient and modern carving. Being overly anxious to eat the hot goose, we endeavoured the carving when the bird was, literally, too hot to handle. Further experimental work is anticipated prior to ICAZ, with a bird that has cooled further!

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#### **GINELLA, F., PLUSS, P. & SCHÄFER, M.**

**Poster:** *Selected archeozoological results of three roman sites from the 4th century AD of the Upper Rhine Valley*

**Session:** General

**Abstract:** The knowledge of settlements of the 4th century AD in the north of the Alps is very sparse. Recently we had the opportunity to study the assemblages of three Roman sites (Pfyn: Kanton Thurgau, Switzerland; Biesheim: Département Haut-Rhin, France; Strasbourg: Département Bas-Rhin, France) in the Upper Rhine Valley. The difficulties in comparing the results will be shown and some topics will be brought into focus.

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#### **GLASSOW, M.**

*Dolphin Hunting on Santa Cruz Island, California*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Between 6200 and 5300 years ago, dolphin hunting was a major subsistence focus of prehistoric peoples living at the Punta Arena site on Santa Cruz Island, California. The dolphin bone assemblage comes from a small test excavation at the site. Considering the small volume of excavated deposits and

the resulting small numbers of dolphin bones identifiable to genus or species, the periotics in the collection were most useful in determining proportional abundance of species. Four species were hunted, and these are currently among the most prevalent in waters of the Southern California Bight. Of the four, northern right-whale dolphin appears most prevalent, implying that hunting either was most intensive during winter months or that intervals of cooler-than-present water temperatures prevailed during the middle Holocene. No other site on Santa Cruz Island is currently known to contain such a high concentration of dolphin bone. Furthermore, at the Punta Arena site, deposits dating prior to 6200 years ago contain no dolphin bone, and those dating later contain a much lower concentration and a lower proportion in relation to fish and pinnipeds. Paleoenvironmental change that affected either the abundance of dolphins or their attractiveness as a focal food resource may partly account for the greater dependence on dolphins between 6200 and 5300 years ago. Alternatively, population growth and development of watercraft, and later fishing technology, may have been the most important determinants. Either set of hypotheses must take into consideration the economic relationships between dolphin hunting and other subsistence pursuits.

**Keywords:** Dolphins, Punta Arena, Santa Cruz Island, California

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#### **GLOVER, E.**

*Intertidal economies: shellfish use in prehistoric Arabia.*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** Shells litter coastal sites all along the Arabian coasts and yet the use of molluscs is often dismissed in a sentence or two at the end of the site report. I am guilty myself of a disclaiming sentence that relegates mollusc use to "probably important but impossible to calculate the relative importance in relation to other sources of food". But to judge by their prehistoric abundance many man hours were spent seeking, collecting and preparing shellfish. Indeed, molluscs from the intertidal are easily obtained and multifunctional in use, providing both food in a variety of flavours and raw material for many kinds of artefacts. In the semi-arid conditions of the Arabian peninsula marine resources of all kinds were especially important. Perhaps it is time to review the evidence for the role of molluscs. In this paper I want to highlight the diversity of species utilised in the past as food and to make material goods, from the neolithic to Islamic periods. Evidence from four well quantified sites will be discussed; these are H3 in Kuwait, dating from 6th millennium BC, the shell midden at Ras al Hadd, Oman dating from the 3rd millennium, the village at Saar, Bahrain from the early 2nd millennium and finally the Islamic site of Kush in Ras al-Khaimah.

**Keywords:** shell, Neolithic, Bronze age, Islamic, Arabian Gulf

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### **GOTFREDSSEN, A.B.**

*Prehistoric exploitation of pinnipeds at Palaeo-Eskimo sites, West Greenland. Sustainable hunting strategies?*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Pinniped remains from Palaeo-Eskimo sites dating from c. 2400 B.C. to 800 B.C., West Greenland, were examined in order to elucidate the past occurrence of species and compared with similar data from Neo-Eskimo sites c. 1000 A.D.-historical times as well as historical sources. The same six extant species, five true seals (Phocidae) and the walrus (*Odobenus rosmarus*) were also found to exist in Greenland waters upon arrival of the first immigrants from Canada. The fauna around the Palaeo-Eskimo localities was diverse and a wide variety of marine and terrestrial resources were exploited, but with small seals forming the basis of their subsistence. Species composition, age profiles, and hunting strategies on small seals with emphasis on the common seal (*Phoca vitulina*) and the walrus were compared for the two periods in question, providing new knowledge on the distribution, breeding occurrence and exploitation patterns in the oldest time of human occupation in Greenland. Results indicate a common occurrence and possibly sustainable exploitation of common seal over a period of 1000-1500 years in Central West Greenland. Recent decline in population size and a decrease in numbers of terrestrial haul outs and breeding sites show that this species is the most vulnerable seal species of Greenland waters. Finds of walrus indicated a more even age profile and extensive coastal occurrence of terrestrial haul outs in prehistoric times, which is in contrast to present day commercial off-shore catches of primarily adult animals. Past exploitation strategies are important to bear in mind in order to ensure that future exploitation is sustainable.

**Keywords:** West Greenland; small seals, common seal, walrus; Palaeo-eskimo cultures; terrestrial haul outs; hunting strategies.

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### **GREENFIELD, H.J.**

*A reconsideration of the secondary products revolution: 20 years of research in the central Balkans*

**Session:** Milk, Milking and Dairying

**Abstract:** This paper will reconsider the evidence for the secondary products revolution in SE Europe, in general, and the central Balkans, in particular. Since its original formulation and testing, almost 2 decades of additional data have been collected. These data show that the processes of change in the region can be temporally variable, and some aspects of the original hypothesis have been difficult to investigate or prove. In this paper, I will present the results of 20 years of research from the central Balkans and elsewhere in SE Europe on the origins and spread of secondary products exploitation. Sites spanning the time from the Early Neolithic to the Early Iron Age will be used to demonstrate whether the additional data support the original hypotheses.

**Keywords:** Balkans, Secondary Products Revolution, Tooth eruption and wear.

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### **GREENFIELD, H.J.**

*Sexing fragmentary ungulate acetabulae.*

**Session:** Ageing and Sexing

**Abstract:** One of the problems plaguing zooarchaeological research has been the paucity of easily sexed specimens. Most attempts at sexing specimens have relied upon measurements. In this paper, I will present the results of my research on sexing fragmentary innominates of ungulates. Two features on the medial wall of the acetabular region, the ilio-pubic ridge and medial border of the acetabulum are shaped very differently in males and females. The space between these two features is the medial wall of the acetabular region. In males, the ilio-pubic ridge is dull and poorly visible, and the medial border of the acetabulum is high. In females, the ilio-pubic ridge is sharp and very visible, and the medial border of the acetabulum is low. In females, the wall is short because the pubic bone is thinner (as a result of the need for the pubic joint to maintain flexibility during reproduction). In males, the wall is high and thick (more massive) because there is no biological function requiring that the pelvic region spread during reproduction. As a result of the conjunction of these features, the wall is high in males and short in females. These features were previously recognized by Grigson (1982) and Prummel (1986) for cattle and ovicaprines. In this paper, I will present data to indicate that these patterns can be extended to ungulates as a whole. Modern comparative data from a variety of taxa are presented in support of this hypothesis. When such methods are applied to zooarchaeological samples, they dramatically increase the frequency of sexed elements, thereby adding an important new element to interpretations of the data.

**Keywords:** sexual dimorphism, innominate, acetabulum, sex determination

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### **GRIER, C.**

*Affluence on the Prehistoric Northwest Coast of North America*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** The prevalent view of Northwest Coast societies as “affluent” rests on the notion that they effectively exploited a highly productive and intensifiable resource base. Zooarchaeological data should therefore play a central role in constructing and evaluating conceptual models of Northwest Coast affluence. However, the role of zooarchaeological data in Northwest Coast archaeology has been relatively limited. As it stands, most models for prehistoric Northwest Coast economies derive from historic-period ethnographic studies. These ethnographic descriptions are being approached with increasing caution by Northwest Coast archaeologists, who are now recognizing that these data may be more historically contingent than previously appreciated. This realization has two implications. First, broader evolutionary models for “affluent foragers” that draw on Northwest Coast ethnographic data may require re-examination. Second, renewed efforts must be made to define a strong role for zooarchaeological data in the study of Northwest Coast affluence, particularly in light of current approaches that focus not only on economic intensification but also the sociopolitical developments that promoted affluence. This paper examines these two issues in an attempt to outline how zooarchaeological information from prehistoric Northwest Coast contexts may contribute theoretically and methodologically to an understanding of the development of affluent coastal economies. The southern British Columbia coast of Canada is used as a case study to illustrate the importance of considering multiple scales of analysis, including the household, village and region, in this endeavour. It is argued that affluence should not be viewed as a homogenous economic property, but rather as a social and political dynamic that fuelled the construction of social difference on the prehistoric Northwest Coast.

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### **GRIGSON, C.**

*Animal behaviour, Human behaviour - Mesolithic adaptations on the island of Oronsay.*

**Session:** General

**Abstract:** Excavations by Paul Mellars and others in several Mesolithic middens on the small island of Oronsay in the Inner

Hebrides yielded remains of birds, mammals and fish. The majority of the avian remains (identified by Don Bramwell) are of guillemots and razorbills obtainable only on the cliffs of the adjacent larger island of Colonsay, although bones of the great auk, which must have nested on the skerries around Oronsay, are equally numerous in most of the middens. These sea birds are highly seasonal, and were systematically exploited from April to early July. There is also a wide range of other birds that could have been obtained opportunistically in various parts of the islands, some only in winter. Most of the mammal bones are of grey seals, many of them pups. Today grey seals breed on the islets south of Oronsay, but during the Mesolithic these would have been submerged, so the breeding grounds were probably on Oronsay itself. Grey seals breed in the autumn. Plots of the size of the red deer suggest that two populations were exploited, a small island form, presumably on Colonsay, and a larger form, on the mainland or one of the larger Hebridean islands. Analysis of the incremental growth of the numerous otoliths of saithe by Mike Wilkinson showed differences between the middens in terms of seasonal occupation, one in autumn, one in winter, one in mid-summer and another in early summer. These differences may be related to seasonal differences in prevailing wind direction determining the choice of landing site close to each midden. Behavioural analysis of the animals exploited in the Oronsay middens shows that people used both Oronsay and Colonsay at virtually all seasons of the year, whether continuously or sporadically. The two islands together, with their wide variety of ecosystems, formed an extremely productive and attractive environment for Mesolithic people. However the death of great auk remains in the one midden that is later in date than the others, suggests that far from conserving an important food resource, the inhabitants of Oronsay hunted the great auk to near-extinction; such over-exploitation may have rendered the Mesolithic way of life finally unsustainable.

**Keywords:** Mesolithic, Hebrides, Foraging, Animal behaviour, Over-exploitation

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### **GROOT, M.**

*Title: Pathological evidence for draught cattle in a Roman site from the Netherlands*

**Session:** Beyond ‘interesting specimens’: palaeopathology and its contribution to the study of animal husbandry

**Abstract:** In Tiel-Passewaaij (The Netherlands) lies an extensive archaeological site dating to the Roman period. The site consists of a cremation cemetery and two settlements. The preservation of bone is good: about 8,000 animal bones have been identified so far. Most of these bones are from domestic animals. On the cattle bones, a number of pathologies were observed which seem to be related to the use of cattle for traction. The different types of pathology are described. Pathology occurs mainly on the hip joint, the metapodials and the phalanges. Other possible causes for these pathologies are discussed. An attempt will be made to

use other osteological evidence to support the use of cattle for traction. The theory that the power of cattle was one of their main products is supported by the age distribution. Although bones from young cattle are found, the older cattle seem to reach a high age. The cattle from Tiel-Passewaaij show a large variation in withers height. The general increase in withers height of cattle in the Netherlands during the Roman period could be linked to a desire for larger cattle who would be better suited to pulling a plough.

**Keywords:** pathology, cattle, traction, Roman, Netherlands

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## GUADELLI, J.-L. & SPASSOV, N.

### *The Pleistocene Equus of Bulgaria*

**Session:** Equids in Time and Space

**Abstract:** In this paper the authors present a short review of the Pleistocene horses founded in Bulgaria. We have identified 7 taxa but two are still unclear. From the Villafranchian sites of Varshets, Slivnitsa and late Villafranchian layers of Kozarnika are coming *Equus stenorhinus*. From the transitional levels from Early to Middle Pleistocene in Kunino we have identified *Equus* cf. *hydruntinus* and few remains of an caballinid (s.l.) horse. The early Middle Pleistocene site of Varbeshnitsa and the same layers in Kozarnika gave stenorhinoid horses, small and rather slender one in the first site. In these layers in Kozarnika we have founded an Equid represented by few fragments of lower jaw teeth with an ectostylid but it's not enough to assume that we have identified an *Hipparion*. In the Middle Pleistocene layers in Kozarnika we identified *Equus mosbachensis*, and in a layer dated from the limit Middle/Late Pleistocene in Zlatna Panega we have strong case to think that *Equus caballus piveteaui* was represented. At last, during all late Pleistocene we are finding in Bulgaria (Kozarnika, Temnata Dupka, Bacho Kiro) *Equus caballus germanicus* and *Equus hydruntinus*.

**Keywords:** Equus, Bulgaria, Pleistocene, Taxonomic diversity

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## HABER, A., DAYAN, T. & GETZOV, N

### *Domestication of pigs in the southern Levant: Hagoshrim as a case study*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Hagoshrim is a prehistoric site in the Hula basin, Israel, excavated by one of us (N.G.). The main cultures represented in the site are PPNC (Layer 6: 8000-7600 BP), Jericho IX (Layer 5: 7100-6800 BP) and Wadi Raba (Layer 4: 6600-6100 BP). Species and artifact composition point to a large agricultural village, with the main species being cattle, caprines and pigs. Cattle and caprines are known to be domesticated in the area by that time, while the status of pigs is questionable. Presented here are the results of a diachronic comparative study of the pig (*Sus scrofa*) remains. The criteria used are changes in kill-off patterns and morphometric characters, emphasizing the recognition of patterns through time. The morphometric data were analysed using Log-Ratio technique along with a two-way ANOVA, enabling to disentangle size from shape. The three criteria are expected to change differently according to the manner in which domestication proceeded. The results are compared to available data from other sites in the southern Levant. The validity of the results is supported by data analyzed for caprines, considered to be fully domesticated by the PPNC in the southern Levant. Significant changes in kill-off patterns, size and shape occur simultaneously with the transition to Wadi Raba, but not between the PPNC and Jericho IX. The changes involve a trend toward a younger culling age and size reduction. The change of body proportions is obvious both in cranial and post-cranial elements. No such changes were found for caprines. The data from Hagoshrim are in accord with finds from other sites, suggesting that pigs were not domesticated in the southern Levant before the end of the Pottery Neolithic. Thus, contrary to previous suggestions, no evidence was found for a prolonged process in which complete domestication is preceded by cultural control.

**Keywords:** pigs, domestication, middle-east, Neolithic, Hagoshrim

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## HAMBLETON, E.

### *Doggy in the well: a review of the evidence and possible interpretations concerning the deposition of dogs in wells and similar features on Romano-British settlements.*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** A recent discovery of multiple dog skeletons deposited in a Romano-British well shaft from Yeovilton in Somerset, England has led to a study of similar multiple dog

burials in shafts, cess pits and comparable features on several other Romano-British settlement sites. Such occurrences tend to be noted in individual site reports but it is apparent that these types of deposits are an increasingly widespread phenomenon from the Romano-British period. The time is ripe for a detailed review of these deposits of dogs, how they compare to each other, and how they might be interpreted as evidence relating to the symbolic, ritual, or more prosaic role of dogs in Romano-British society. This paper will summarise some of the evidence for finds of dog skeletons in Romano-British wells, shafts, and other similar features. In addition to the dog skeletons themselves (their number, size, age and completeness), other factors to consider include associations with other faunal and artefactual material, and the location and type of the features in which the dogs were deposited. Where possible, such information will be used to make inferences concerning the depositional history of dogs in particular features. A comparison of the characteristics of these deposits will be made in order to highlight recognisable trends and similarities. A variety of interpretations will be considered including: symbolic or ritual deposition related to Roman religious beliefs; the possible continuity of 'Celtic' beliefs linked with deep deposits such as wells and shafts; deposition related to change in site function; and selected culling as a means of population control.

**Keywords:** Dogs, Romano-British, wells, deposition, interpretation

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## **HANDLEY, B.M.**

**Poster:** *The role of the sharks in prehistoric North America*

**Session:** General

**Abstract:** This poster reflects archaeozoological research conducted during the past decade along the Atlantic coast of the United States regarding the role of sharks in cultures prior to European colonization. Specific species of shark were targeted for consumption, while others may have been held with great purpose. Vertebra centrums and dermal denticles of certain species are consistently recovered in refuse deposits, while remains from larger more aggressive species, such as the great white, are represented mainly by teeth in burial contexts. This pattern suggests specific roles in the cognitive land or seascape with regard to species.

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## **HARLAND, J.**

**Poster:** *The York System: a database for zooarchaeological recording*

**Session:** General

**Abstract:** 'The York System' is a Microsoft Access database application for animal bone recording and analysis. The recording methodology is based on that developed at the University of York, incorporating protocols from both the Environmental Archaeology Unit (mammals and birds) and the Department of Archaeology (fish). The system provides an easy-to-use recording interface that ensures users can record data quickly and efficiently. Features include: diagnostic zone images that allow users to select areas of bone at a click of the mouse; full integration with von den Driesch measurements; most mammal, bird and fish species and elements found on British archaeological sites; easy customisation for unusual species and elements; and a number of built-in reports providing common summary data, including MNI and MNE, etc. The system also includes a comprehensive help file that explains various aspects of recording methodologies, as well as leading the user through the recording process. No knowledge of database systems is assumed or necessary. Although the system is an excellent device for teaching recording procedures, it can also be used by experienced zooarchaeologists.

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## **HELMER, D., SAÑA-SEGUI, M., GOURICHON, L. & PETERS, J.**

*The use of sex determination for the identification of domestication in cattle: an example from the Middle Euphrates.*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The identification of domestication in ruminants is usually carried out using biometrical analysis and comparing the results with data from wild specimens. For cattle as well as other taxa, the major difficulty when one observes a reduction in size is to establish if this reduction is due to climatic factors, a cynegetic stress (over-hunting), a preferential hunting of females, or as a result of domestication. The first hypothesis can be evaluated by correlation with palaeoclimatic data. The second hypothesis by a comparison with strictly wild species such as gazelles. The third and fourth hypotheses require the distinction between male and female, readily carried out with aurochs but more problematic with domestic cattle. The recent excavations (Göbekli, Dja'de, Halula) and the study of material from Mureybet provide a significant sample from a relatively small region with comparable climatic conditions, where sites are separated by less than 200 km and range from PPNA to Middle PPNB. On condition that the distinction between male and female specimens is carried out, it is possible to provide evidence for cattle domestication in the region since the Early PPNB.

**Keywords:** Domestication, Sex-ratio, Near-East, Cattle, Neolithic.

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### HERMAN, J.S. & DOBNEY, K.M.

**Poster:** *Evidence for an Anglo-Saxon bottlenose dolphin fishery in the North Sea*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Recent archaeological excavations of a high status Anglo-Saxon settlement at Flixborough, close to the Humber Estuary in eastern England, has yielded the largest archaeological sample of cetacean tooth and bone fragments yet found in Britain. Even more interesting was the fact that almost all were from a single species, the bottlenose dolphin (*Tursiops truncatus*). Determination of the species and the skeletal elements present in the assemblage, evidence of butchery and the size and age profile of the animals concerned is strongly suggestive of the selective hunting of larger animals. Harpooning is perhaps the most likely method, given that netting or driving would indiscriminately capture animals of all ages. This specific age/size profile (in addition to comparisons with the available UK cetacean stranding records of the last 90 years) also excludes the possibility that these animals are the result of opportunistic exploitation of animals that were naturally stranded. These Saxon bottlenose dolphin remains from Flixborough provide the first reliable evidence for the existence of an indigenous cetacean fishery in the British Isles and predates the more traditionally view that this began in England during the high mediaeval period. This fishery was probably organised to supply the high ranking aristocrats and nobility living at the site and appears to have focused almost exclusively upon a resident population of bottlenose dolphins that was present in or around the Humber estuary at least from the early-mid 8th AD. Since there are no historical records of this population, hunting may even have played a part in the its eventual extinction from local waters. The finding is significant in suggesting that indigenous cetacean fisheries may have been more widespread in Europe than is apparent from the limited archaeological and documentary evidence available.

**Keywords:** Cetacean, dolphin, Anglo-Saxon, fishery, Flixborough.

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### HESSE, B. & WAPNISH, P.

*Iron Age dogs in the Southern Levant: two “tails”*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Two recently discovered collections of dog remains paint radically different pictures of dog use in the early Iron Age in the Southern Levant. Coastal Philistia has produced significant evidence of butchered dog remains and two puppies in cooking pots. By contrast, the remains found at a contemporary Jordan Valley site suggest the existence of a “dog ossuary.” The significance of these finds in the context of the construction of cultural identity in the region will be explored.

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### HODGETTS, L.

*Dorset Palaeoeskimo Harp Seal Exploitation at Port au Choix Newfoundland*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** The Dorset Palaeoeskimo site of Phillip’s Garden (EeBi-1), located on the north-west coast of Newfoundland, Canada, was occupied between roughly 2200 and 1300 BP. Within about 100 years of the abandonment of the site, the Dorset disappeared from Newfoundland. A better understanding of the factors contributing to the abandonment of Phillip’s Garden may help to explain their departure from Newfoundland. Throughout the history of occupation at Phillip’s Garden, the site represented a very specialized regional adaptation of the Dorset, centred on the intensive exploitation of migrating harp seals (*Phoca groenlandica*). All excavated middens and house depressions on the site have produced faunal assemblages overwhelmingly dominated by seal (almost certainly harp seal). One notable exception is a midden feature dating from the final phase of the site’s occupation. It is unlike the other Phillip’s Garden assemblages in that it displays: 1) considerably larger proportions of fish and bird bone and 2) a very large number of juveniles among the seal remains. This



suggests a change in Dorset subsistence practices towards the end of the site's use. A number of alternative explanations will be evaluated, any or all of which could have taken place shortly before the abandonment of Phillip's Garden. These include the introduction of new disposal practices for animal remains, a change in the local availability of harp seal, and a different season of use or length of stay at the site.

**Keywords:** Harp seal (*Phoca groenlandica*), Dorset palaeoeskimo, hunting strategies, Newfoundland

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## HOGARTH, P. & BEECH, M.

*Modelling ancient crab consumption in the Arabian Gulf and Gulf of Oman*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** The study of crab remains from archaeological sites is an often neglected area of study in zooarchaeology. On many coastal sites in the Arabian Gulf and Gulf of Oman crabs made a regular contribution to the diet of the coastal inhabitants. There is even some evidence for crabs being exported to the interior of the south-east Arabian peninsula. Fieldwork was carried out by both authors to record and collect the modern day crab species which occur along the coastline of the United Arab Emirates. This baseline study identified the first authenticated records in the Arabian Gulf of the mangrove crab (*Scylla serrata*) as well as of a further mangrove-associated species, *Perisesarma guttatum*. The result of this work was the creation of a reference collection which enabled the identification of archaeological crab remains recovered from a number of archaeological excavations in the region. To date material has been identified from a total of 12 excavations, located in Kuwait (1 site), Saudi Arabia (1 site) and the United Arab Emirates (10 sites). These range in date from the late 6th/early 5th millennium BC to the Late Islamic period. The majority of the archaeological crab remains identified belonged to swimming crabs (*Portunus* spp. and *Scylla serrata*). Remains of *Scylla* have been recognised at several archaeological sites in the Emirates. The strong association of this particular crab species with mangroves indicates that human populations were dependent on mangroves, and were already exploiting them for food as well as other resources like fuel and timber, as long as 3000 years ago. In this paper the overall distribution of crab remains is discussed. Several hypotheses are advanced to explain the interesting distribution of archaeological crab remains.

**Keywords:** crab, *Portunus*, *Scylla serrata*, Portunidae, distribution

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## HOGUE, S.H.

*Carbon isotope and microwear analysis of dog burials: evidence for maize agriculture at a small Mississippian site*

**Session:** Integrating Zooarchaeology

**Abstract:** Animal remains can provide evidence for maize agriculture in archaeological populations when more traditional methods are not possible. One example is the Josey Farm site, 22OK793, a Mississippian site in Oktibbeha County, Mississippi, excavated in the late 1990s. The site yielded no ethnobotanical evidence for maize agriculture, even though feature fill was processed using standard flotation methods. Furthermore, no human burials were recovered where carbon isotope analysis could provide direct evidence for maize use. The only evidence for maize use was provided through the analysis of small mammal remains, which indicated possible land clearing, presumably for agricultural practices. In order to substantiate maize use at the site, a dog burial is assayed for carbon isotope levels and microwear patterns are analyzed. Similar data from dog and human burials recovered from a nearby site are included for comparative purposes. The results indicate that dog remains can provide information on human plant food diet and site function when other sources of evidence are unavailable.

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**HOHENSTEIN, U.T., CILLI, C., FONTANA, F., PIZZIOLLO, G., DESTRI, M., BERTOLA, S., LIAGRE, J. & GUERRESCHI, A.**

**Poster:** *Organisation of living-floors in the site of Riparo Tagliente (Stallavena di Grezzana, Verona) during the end of the Upper Palaeolithic (Late Epigravettian). Integrated analysis of technological, functional and palaeoeconomic attributes and spatial data.*

**Session:** General

**Abstract:** In this poster we will present a preliminary report on the results of an interdisciplinary research carried out in the year 2002. The research seeks to contribute to clarify behavioural patterns among hunter-gatherers groups relating both to the social and economic sphere and to examine the impact of natural processes on the archaeological record. It focuses on an integrated analysis of technological, functional and palaeoeconomic attributes and spatial data from Late Palaeolithic

layer S.U. 11 (Late Epigravettian) of the site of Riparo Tagliente (Stallavena di Grezzana, Verona). Riparo Tagliente, which is situated under a rock-shelter on the Valpantena valley bottom, in the Lessini Mountains (Verona), represents one of the most important Palaeolithic sites in Northern Italy. More specifically, this study is based on the integration of spatial data obtained by map digitalisation of the structures identified during excavation campaigns, and of attributes resulting from the analytical study through different methods of analysis of two categories of finds (basically lithic artefacts and faunal remains). The final goal is to isolate those materials whose presence is strictly linked to the human action from other finds affected by edafic agents such as animals or other natural phenomena responsible for rearranging the refuse generated by human activities. Furthermore the processing of the spatial distribution maps will be used to contribute to the interpretation of the functional and structural characteristics of the area itself.

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## **HORWITZ, L.K.**

*An archaeozoological and ethnographic investigation of camel milking in the southern Levant*

**Session:** Milk, Milking and Dairying

**Abstract:** Although the camel plays an important role in the economy of Bedouin inhabiting the desert areas of the southern Levant; the Sinai desert of Egypt, the Negev desert of Israel and the eastern deserts of Jordan, little information is available concerning the antiquity of this animal in the region, and even less concerning its exploitation for milk. Based on the archaeozoological record of the southern Levant, this paper summarises the currently available evidence for camel exploitation in this region with a special focus on camel milking. In addition, present-day ethnographic data on camel milking is presented based on information obtained from extant Bedouin communities in the region and a modern camel farm in the Negev desert.

Key words: Southern Levant, Negev desert, eastern Jordan, dromedary, camel milk

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## **HORWITZ, L.K.**

**Poster:** *The exploitation of small mammals, carnivores and reptiles in the arid margins of the southern Levant*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The desert margins of the southern Levant [Negev desert Israel; eastern deserts Jordan; and Sinai Peninsula Egypt] are characterised by extremely low rainfall, high temperatures and Saharo-Sindian vegetation cover. Despite the harsh conditions, a broad range of small sized mammals such as hares, rodents and carnivores as well as reptiles inhabit these regions. The remains of these species are commonly found in prehistoric and archaeological sites throughout the region but are especially common in these desert regions. This presentation documents the exploitation of small sized mammals and reptiles in a diachronic series of sites - Upper Palaeolithic through to Bronze Age - located in the deserts of the southern Levant. Data on abundance, procurement strategies, butchery and food preparation are examined in an attempt to reconstruct exploitation strategies over time.

Keywords: small mammals, carnivores, reptiles, Southern Levant, deserts

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## **HORWITZ, L.K., RABINOVICH, R. & BRANDE, S.**

*Macro and micro-damage on bones from captive hyaenas and hyaena dens*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** Animal bones fed to captive striped hyaenas (*Hyaena hyaena*) as well as a small sample of bones collected from a striped hyaena den in the Negev Desert, Israel were studied. The pattern and location of all damage on the bones was recorded. Macro-damage included the extent of the bone damaged, the form of the damage as well as the profile of the remaining edge. Micro-damage entailed scoring the location and number of surface marks such as puncture marks, furrows, striations and pits. Identification of these marks was carried out under magnification, as was measurement of furrows, striations and punctures (length and width). Comparison was made between the pattern of damage noted on bones eaten by the captive hyaenas and those collected from the hyaena den. In several parameters significant differences were found between the two samples, despite the fact that the carnivore agent responsible for the damage was the same. The reasons for these differences as well as the contribution of metrical studies of bone micro-damage to the identification of carnivore agents, is discussed.

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## HUDSON, J.

*Changing Patterns in Marine Resource Use along the Peruvian Coast*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** The zooarchaeology of coastal Peru shows a long and diverse set of adaptations to a rich marine habitat in conjunction with extremely arid terrestrial environments. Prehistoric sites along the more arid south coast show shifts over time in the balance of the importance of birds, marine mammals, and fish. The excellent organic preservation afforded by the desert climate facilitates an understanding of both food and non-food uses of marine resources. The somewhat less arid north and central coasts show similar beginnings but different trajectories of development, in which fishing communities first support monument building and then become specialists within a much larger regional political system, and the importance of marine resources sources is expressed in ceramic art and iconography.

**Keywords:** birds, marine mammals, fish, iconography, Peru

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## HUDSON, J.

**Poster:** *Reed boat fishing in northern Peru*

**Session:** General

**Abstract:** Opportunities to study coastal fishing communities that rely on hand-crafted technology, including reed boats, are now rare. This study of a modern fishing community on the north coast of Peru focuses on three aspects with potential for modeling prehistoric fishing. These are: 1) the costs and benefits of reed boat manufacture and use, including the management of gardens of wild reeds; 2) the costs and benefits of fishing with nets and traps; and 3) social aspects of the division of labor by age and sex within an extended family. Regional archaeology documents a long tradition of the importance of marine resources and settlements, and the artistic representation of reed boats is seen in local ceramics that date to almost 2000 years ago.

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## IKEYA, K.

*Mobility and Territoriality among Hunting-Farming-Trading Societies*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Ethnographical studies have showed that few hunter-gatherer societies anywhere in the world subsist solely through hunting and gathering. Most of them follow a complex subsistence economy consisting of hunting, gathering, farming, fishing, herding, and trading etc. The author has conducted fieldwork on the ecology and social history of complex subsistence economies among the Kalahari San (Bushman) in Botswana and the mountain people called Matagi and the Ainu in northeastern Japan. The San has combined hunting like hunting with dogs, equestrian hunting, and trapping with other subsistence activities, such as goat raising and dry farming and trading furs with the Kalagadi agropastoralists. On the other hand, the Matagi and the Ainu combined bear hunting, salmon fishing, farming, and trading with Japanese traders etc. In this report, I clarify the relationships between the mobility patterns and territoriality in particular groups and between groups among the hunting-farming-trading societies. The author proposes two kinds of development process in territorial systems; from “common type” to “division type” or “nawabari type” in semi-nomadic mobility societies, and will discuss the differences in the extent of human pressure impacting on natural resources according to the relationship between the levels of trading activity and territoriality patterns.

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## IKRAM, S.

*"Typhonic Bones?"*

**Session:** General

**Abstract:** The paper concerns a most striking faunal assemblage from the 2000 Polish mission to Saqqara (Egypt). It consisted of a very unusual deposit of bones, possibly ritual, found in the chamber located at the end of a rock-cut corridor (Corridor 1). The assemblage was arranged in a loose circle, with some disruption caused by bioturbation due to rodents, insects, other animals (canids or foxes?), and rock falling from the ceiling. The majority of bones were all on one level, with some bones being at a slightly lower level (varying between 0.5-2.0 cm) than the others. The assemblage consisted primarily of animals' heads and very few other body parts. The species represented in this group are extremely unusual in funerary or even ritual (e.g. foundation deposits) contexts: catfish (*Clarias*), *Synodontis*, donkey (*Equus asinus*), pig (*Sus scrofa*), hartebeest (*Alcelaphus*

*bubalis*), and canid (*Canis familiaris/aureus*). The unifying theme amongst these taxa is their association with wild, chaotic, and Typhonic forces. It is extremely probable that these bones are related to the encased harpoon found in the dirt about 1.4 m below, and its accompanying deposit of sixth dynasty pottery.

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## IOANNIDOU, E

*The effect of dog scavenging on a modern cattle, pig and sheep bone assemblage*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** Carnivores have been known for long as a taphonomic agent that accumulates and destroys bones thus introducing biases in archaeological bone assemblages. This paper examines how the scavenging by two domestic dogs affected the composition of a modern assemblage comprised of limb bones of cattle, pig and sheep. The dogs did not manage to inflict any serious damage to the cattle bones whilst pig and sheep bones suffered very heavy attrition. The density of the bones was found to have mediated the destruction to a certain extent but other parameters appeared to be more crucial. The size and maybe the shape of the bones seemed to be more important factors since cattle bones of similar density to the pig or sheep received little attrition whereas the bones of the two other species were destroyed. The nutritional value of the bones was also important. Not only the dogs preferentially attacked parts with soft tissue attached but also they left mostly complete the acetabulum of the pelvis despite its low density value. The jaw power and individual behaviour of the dogs influenced the manner of destruction to a minor degree. The variety of the factors involved makes difficult to construct destruction models of general application. Nevertheless, when the same element of the same species was offered to both of the dogs, the fragments remained after each 'gnawing' session were very much similar. Finally, to estimate the bone loss and the bias scavenging had introduced to the assemblage, species proportions and skeletal representation tables were calculated and the flaw in estimating the original bone assemblage was assessed.

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## JACOBSON, J.

*Faunal analysis and human ecology: a method for differentiating between *Odocoileus hemionus* and *Odocoileus virginianus* using post-cranial remains*

**Session:** General

**Abstract:** North American archaeologists have long been concerned with the ecological interaction between Native

Americans and their environment. Bison utilization has been the primary zooarchaeological focus of this research in the Great Plains region of North America. However, while Bison were the predominant food source in this region, they were not the only animals utilized. Both mule deer (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*) occur in the Plains region of North America and overlap with one another in geographic space. Both of these species were also widely used by prehistoric individuals. However, the two species prefer different habitats and tend to occupy distinct ecological zones. The prehistoric distribution of the genus *Odocoileus* is fairly well known, but the prehistoric distributions of the individual species are not. All current identification techniques of these species rely on cranial material. To date there has been no method developed for differentiating between the two species based on post-cranial skeletal material found at archaeological sites. However, the two animals have very different gaits and other behavioral adaptations that should affect the morphology of their lower limbs. For this study a modern sample of limb bones from both species of deer was collected. All the deer analyzed were acquired from the Plains region of North America in areas where the two deer species have overlapping ranges. General morphological analysis and biological measurements were conducted on the modern sample to determine possible means of classifying skeletal differences useful for identification. Statistical methods were then applied to the biometric data to determine the significance of these differences. The results of this study should aid future archaeological research. The ability to identify these species in archaeological context could greatly bolster our knowledge of human ecological use in the Great Plains, as well as, help determine the prehistoric dispersal of the two animals.

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## JANETSKI, J.

*Shifts in Epipaleolithic Marine Shell Exploitation at Wadi Mataha, Southern Jordan*

**Session:** Archaeo-Malacology

**Abstract:** Marine shell occurs throughout the Epipaleolithic sequence at Wadi Mataha; i.e., from Geometric Kebaran through Early and Late Natufian. Although analysis of the 2001 collections are ongoing, Dentalium and *Vermetus* appear most abundant with holed gastropods (especially *Nerites*) also common. Dentalium and disk beads appear to increase in the Natufian levels. As with the Beidha Natufian shell assemblage (Reese 1991) the source of the Wadi Mataha shell tends to favor the Red Sea to the south during all periods.

**Keywords:** Geometric Kebaran, Natufian, marine shell, Red Sea

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### **JANS, M.M.E., COLLINS, M.J. & KARS, H.**

#### *Monitoring of animal bone assemblages in situ*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** Part of archaeological heritage management is preservation in situ of archaeological sites. This requires an active approach. Physical quality (and if possible the degradation mechanisms playing a role at the site) and archaeological value are to be assessed before making the decision on preservation in situ. Then it is often necessary to take active measures for protection. Sampling archaeological material like bone for quality assessment of archaeological material in situ and monitoring it over a period of time to identify the influence of changing environmental parameters is usually done by auger surveys or trenches. Through the nature of these sampling methods it is most likely that animal bone from occupation layers or assemblages will be obtained. However, in assessing diagenesis in animal bone, a few factors need to be considered. Animal bone can be expected to have an elaborate taphonomic history, it might be butchered, de-fleshed, perhaps even cooked. It is also likely to have been exposed for some time prior to burial. This has certain consequences for diagenesis. As an example of a monitoring study Voorne Putten, South Holland, will be discussed. In this study 10 sites on the former island of Voorne Putten were sampled using an auger survey and the physical quality of bone evaluated while environmental parameters were monitored.

**Keywords:** Preservation in situ, Animal bone, Monitoring, Diagenesis, Sampling

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### **JING, Y.**

#### *Dogs in the Chinese Neolithic*

**Session:** General

**Abstract:** Most Chinese Neolithic sites contain a few, fragmented dog bones, but it seems dogs had not yet become an important meat source. The remains suggesting domestication

are dog skeletons deliberately placed in pits. The earliest evidence of pits burials has been discovered at Jiahu in Wuyang County, Henan Province (ca. 9000 BP), where eleven dog skeletons were found buried in house floors and graves. These dogs were all buried after being killed, as suggested by the various orientations in which their limbs were placed. In the Chinese Neolithic (ca. 9000-4000 BP), the practice of intentionally burying dogs is primarily concentrated around 27 sites in the lower reaches of the Yellow River valley and in the east. The various postures of these dogs seem to indicate that they were killed first and then buried. However, in a few cases the dog skeleton was all bundled together; perhaps these dogs were buried alive. Buried dog skeletons primarily have been discovered in cemetery areas, in residential areas, and outside the ditches surrounding some settlements. Those buried in graves can be divided into two types: buried alone and as a form of burial good. The former were placed in a laid-out posture. The dogs which served as burial goods were placed in the graves of both males and females, and with adults as well as adolescents as young as ten years old. These dogs were also placed in a laid out posture, situated below the feet of the deceased. Dogs buried in residential areas also include two types: buried between houses, and below the floor within houses. Those buried outside the settlements were found at the base of round, bag-shaped pits. Burial of complete dog skeletons in these contexts is possibly related to ritual, grave furnishing, or the foundation of new sites and buildings.

**Keywords:** China, Neolithic, dog

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### **JOCHIM, M**

#### *The Implications of Food Exchange for Hunter-Gatherer Affluence*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Models of hunter-gatherer organization and change often downplay the influence of interaction with neighbors on internal features of society. In particular, there has been a tendency to ignore the role of food exchange among hunter-gatherers, largely due to its unimportance among groups such as the !Kung and Australian Aborigines. Among other groups, however, exchange of foodstuffs plays an important role. The implications of this exchange for the organization of production and technology and the patterns of settlement will be explored.

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### **JOHANSSEN, N.N.**

#### *Palaeopathology and Neolithic cattle traction: methodological issues and archaeological perspectives.*

**Session:** Beyond 'interesting specimens':  
palaeopathology and its contribution to the study of animal husbandry

**Abstract:** The earliest use of draught animals has been subject to many speculations, but few systematic studies. While pioneering methodological work has started to provide the necessary tools for an osteological identification of draught cattle, little attention has been directed towards faunal assemblages from Neolithic sites. An initial attempt to investigate the use of cattle for traction purposes in a European Neolithic context is presented here. Lower limb bones of domestic cattle from the Middle Neolithic site of Troldebjerg, Denmark, have been examined using methods developed by Bartosiewicz et al. (1997). However, an additional study of lower limb bones from early Mesolithic aurochs individuals has suggested that some of the criteria previously used to identify draught cattle should be modified, and has stressed the importance of studying comparative samples with different age structures than those found in modern, meat production herds. Furthermore, the present paper argues that the adoption of cattle traction not only had profound, long-term consequences for agriculture, but also for the development of terrestrial infrastructures in the Neolithic.

**Keywords:** palaeopathology, cattle, traction, Neolithic, infrastructures

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## JOHNSON, L.L.

*Prehistoric Aleut Sea Mammal Hunting, Ethnohistoric and Archaeological Evidence.*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** The prehistoric Aleutian Islanders were obligate marine hunter-gatherers. Terrestrial foods, spring roots and shoots and summer berries, and littoral invertebrates, while important, particularly during inclement weather, provided only supplementary nutrition. The majority of the diet came from fish – most prominently salmon, cod and halibut – and sea mammals - whales, sea lions, seals and sea otters. The ethnohistoric evidence indicates that the Aleut had special tools for hunting each of these mammals and that their capture was ringed round with cultural prescriptions and restrictions. Sea mammals were also central in Aleut mythology, and they, like the Eskimo, believed in human/animal transformations. Archaeological evidence clearly demonstrates the alimentary and industrial importance of sea mammals to the Aleut and provides tantalizing glimpses of their symbolic value.

**Keywords:** Aleuts, North Pacific, sea mammals, Ethnohistory, mythology

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## JOHNSTONE, C.

*Those elusive mules: investigating biometric methods for their identification.*

**Session:** Equids in Time and Space

**Abstract:** The research that forms the basis of this paper was undertaken as part of my PhD thesis, entitled Equids in the Roman World. The aims of this study are to carry out a zooarchaeological investigation of equids during this time period. As the Roman period is perhaps the only era from which there are written accounts of mules being present in large quantities, it is vitally important to be able to distinguish their bones from those of the parent species. A considerable amount of work has been done on the separation of donkey (*Equus asinus*) and horse (*Equus caballus*) bones but very little on distinguishing those of mules from either. As the main part of my thesis involves the use of biometric data, mainly from published sources, it was decided that a biometric method for separating horses, donkeys and mules would be most appropriate. In the initial stages of the research, published methodologies were evaluated. However, as these did not seem to be producing reliable results, more sophisticated statistical methods were applied to the data. This paper will present the results of discriminant function analyses on biometric data collected from modern reference collections, and also on a limited amount of archaeological data.

**Keywords:** Biometry, Identification, Mules, Multivariate statistics, Roman Empire.

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## JONES, A.

*The supply of fish to a high status house in Pompeii: a consideration of the architectural, and archaeological evidence*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Excavations near the Herculaneum Gate, by the Anglo-American Project in Pompeii co-ordinated from the University of Bradford since 1995, have produced a large number of samples of fish remains recovered by a systematic sieving campaign. While much effort has concentrated on understanding the form and function of an elite first century House of the Vestals, a complex structure replete with mosaic floors, wall paintings and elaborate water supply systems, excavations have also revealed evidence for earlier occupation of

the site, timber buildings probably associated with agricultural activity. The assemblages of fish remains from early and late deposits will be compared to show how species representation, taphonomic considerations and architectural features can help to identify high status economic activity.

**Keywords:** Fish remains, Pompeii, garum, taphonomy, status

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## JONES, G.G.

*Tooth eruption and wear observed in live sheep from Butser Hill, the Cotswold Farm Park and five farms in the Pentland Hills*

**Session:** Ageing and Sexing

**Abstract:** Following the method used on modern Turkish angora goats by Deniz and Payne, 1600 observations were made on live sheep in the UK. Breeds included Soay, Scottish Blackface, Shetlands, other traditional breeds, and some commercial crossbreeds. The date of birth was known for most of the sheep. The lower left mandible was observed and the incisor and cheek teeth recorded. M1 was seen to come into wear at 3 months, with a few Soays at 4 months. M2 came into wear at 10 to 13 months. M3 erupted before P4 in all cases. M3 normally came into wear at 20 to 27 months. Incisor eruption was more variable than molar eruption. Erasure of the infundibula of M1 was very variable. Sub-division of Payne's stages C, D and E is of value. Results are promising for seasonality studies for first year sheep. Breed differences are commented on.

**Keywords:** sheep age, tooth-eruption, tooth-wear seasonality, age determination

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**KADWELL, M., FERNANDEZ, M.,  
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BRUFORD, M.W.**

*Genetic analysis of the origins of the llama and alpaca*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The origins of South America's domestic alpaca and llama are controversial due to hybridisation, near extirpation during the Spanish conquest, and difficulties in archaeological interpretation. Traditionally, the ancestry of both forms is attributed to the guanaco while the vicuña is assumed never to have been domesticated. Recent research has, however, linked the alpaca to the vicuña, dating domestication to 6 - 7,000 BP in the Peruvian Andes. Here we examine in detail the genetic relationships among the South American camelids to determine the origins of the domestic forms, using mitochondrial (mt) and

microsatellite DNA. MtDNA analysis places 80% of llama and alpaca sequences in the guanaco lineage, with those possessing vicuña mtDNA being nearly all alpaca or alpaca/vicuña hybrids. We also examined four microsatellites in wild, known provenance vicuña and guanaco, including two loci with non-overlapping allele size ranges in the wild species. In contrast to MtDNA, these markers show high genetic similarity between alpaca and vicuña, and between llama and guanaco, although bi-directional hybridisation is also revealed. Finally, combined marker analysis on a subset of samples confirms the microsatellite interpretation and suggests that the alpaca is descended from the vicuña, and should be reclassified as *Vicugna pacos*. This result has major implications for the future management of wild and domestic camelids in South America.

**Keywords:** Mitochondrial DNA, Llama, Alpaca, Camelids, Domestication.

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**KANSA, S.W. & CAMPBELL, S.**

*Feasting With the Dead? – A ritual bone deposit at Domuztepe, a Halaf (ca. 5200-4500bc) site in south central Turkey*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The Halaf period in the Near East (ca.5200-4500bc) saw important developments in social complexity illustrated by elaborate craft production, seal impressions, and the development of long-distance exchange networks. This period laid the foundations for the later rise of Near East state institutions. The site of Domuztepe is located at the northeastern extreme of the Halaf cultural phenomenon in south

central Turkey. Domuztepe is the first large, densely populated Halaf site to be excavated, offering a unique window on 5th millennium bc settlement in this region. A unique feature of the Domuztepe settlement is a large “burial pit” in which portions of at least 40 human skulls were found along with disarticulated post-cranial bones. The later stages of this complex burial rite were marked by the deposit of large quantities of ash and a single articulated burial. This area was the center of later ritual activity. Animal bones were found associated with the human bones in the pit. This paper presents results of a detailed examination of the animal remains in this ritual deposit. The results of this study are critical to a better understanding of both the overall ritual activity and the social strategies that integrated an early large-scale society. The identified portion of the Domuztepe faunal assemblage consists of 10,000 fragments, about 1,400 of which come from this pit. The nature of the faunal remains from this pit are compared with those from the rest of the site. Differences in body part representation and in relative abundance of taxa between the two areas reflect human choice and preservation biases. The role played by cattle in forming this special assemblage is highlighted. The results from Domuztepe are compared with archaeological and ethnographic parallels as we attempt to understand the nature of the (likely) ritual feasting that formed this assemblage.

**Keywords:** Domuztepe, Halaf, Feasting, Human remains, Turkey

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**KANSA, S.W., KANSA E.C. & LEVY, T.E.**

*Eat like an Egyptian? A contextual approach to an Early Bronze I “Egyptian colony” in the southern Levant*

**Session:** Integrating Zooarchaeology

**Abstract:** This study focuses on evidence for interaction with Egypt recovered from late Early Bronze I (3600-3000 BCE) contexts excavated at Nahal Tillah (Israel), from 1994 -1996, by the University of California, San Diego and Hebrew Union College. The ceramic assemblage, bread molds, an Egyptian-style “tomb”, and other small finds (faience jars, serekhs, etc.) point to a significant, but enigmatic, Egyptian presence at this site during the later part of the Early Bronze IB. Some researchers suggest the Egyptian presence at Nahal Tillah (and at other nearby contemporary sites) represent the settlement of an alien “colonial” population from Egypt. This paper integrates zooarchaeological and ceramic research at Nahal Tillah, in order to understand better the nature of the Egyptian presence at this site. Following a review of the ceramic and animal bone data, this paper focuses on the contextual and spatial patterns of these

finds across the site. Using Geographic Information Systems for data visualization, the distribution of pottery and bones are compared. The effects of contextual integrity, depositional, and post-depositional forces on spatial distributions are also assessed. Even during the height of the Egyptian presence at this site (when the highest proportion of Egyptian ceramics are found), though the spatial distribution of different types of ceramics are clearly patterned, there is little evidence for spatial segregation between Egyptian and Southern Levantine-styled pottery across the site. zooarchaeological finds show less clear intra-site patterning. These ambiguous spatial relationships contrast with results from Hacinebi (Turkey), an “Uruk Colony”, where strong spatial patterning and segregation appeared in both the zooarchaeological and ceramic assemblages. Processes of deposition and/or greater integration or more fluid social boundaries between “Egyptian” and “local” populations may explain these results from Nahal Tillah.

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**KARALI, L.**

*Shells from Prehistoric sites of Northern Greece*

**Session:** Archaeo-Malacology

**Abstract:** Northern Greece is a region of vast archaeological importance. Macedonia and Thrace are the links to the northern European and eastern influences, due to their geography and geomorphology. The prehistory of these areas is still not well known but the archaeological excavations, the surveys and the analysis of archaeological and paleoenvironmental materials contribute to the building of a certain knowledge of the provided is invaluable as they attest the variety of species, the biotopes and therefore the seashore, the activities of the inhabitants and the cultural impact. During the Neolithic and the Bronze Age period the landscape was different. Actually the drainage of the marshes and the alluvial depositions as well as the intensive exploitation of the agricultural areas do not reflect the reality of the past. The archaeological and the paleoenvironmental investigation contribute to the understanding of the natural and anthropogenic changes. For example coastal sites of the past nowadays have a distance from the sea. The local cultural development is similar to the development of the Balkans and the Northeast Aegean. Human groups move from the coast inland using the net of the big and small rivers and the lakes carrying and exchanging goods and ideas as the Spondylus artifacts attest.

**Keywords:** Aegean, Alluvial, Fishery, Diet, Spondylus



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**KELLY, L.**

*The Potential Ritual Significance of Some Animals from  
Mound 34 at the Cahokia site*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The Cahokia Mounds site in the central Mississippi river valley is the largest and most complex archaeological site in North America outside Mexico. It has been a long-held view that Cahokia as a paramount mound center experienced its peak during the Stirling phase (AD 1100-1200) and the Moorehead phase (AD 1200-1275) marks the beginning of a state of social decline before the site was abandoned around AD 1350. Past and recent investigations into Mound 34 at Cahokia, located at the north edge of a line of mounds that define the west boundary of the East Plaza, are providing significant information about the site's Moorehead phase (AD 1200-1275) occupation that dispels the view of social decline. Rather, it appears the area of Mound 34 during the Moorehead phase was a significant locus, where special activities, events, and religious ceremonies were taking place. In 1957 Paul Parmalee identified and reported a very diverse faunal assemblage from Gregory Perino's 1956 excavations in and near Mound 34 at Cahokia. Recent Mound 34 excavations help clarify the contextual and chronological placement of this assemblage. In this paper, I examine the potential ritual significance for part of this faunal assemblage, particularly the birds, in light of the new information from Mound 34 as well as recent faunal research at the site. I believe the faunal data provides another line of evidence to support the new view that during the Moorehead phase, certain areas of Cahokia displayed a social vibrance rather than a decline.

**Keywords:** Cahokia site, Mississippian, birds, ritual, Moorehead phase

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**KIM, J.**

*Environmentally-Given Affluence or Strategically-  
Chosen Affluence? : Land-Use Strategies among  
Foraging Groups of the Central-Western Korean  
Chulmun Period*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Current models of affluent foragers (and/or complex hunter-gatherers) tend to consider environmental affluence as key to understanding economic and social aspects of these

people. Focusing on sedentism (or lower degree of residential mobility) of these groups, major concerns have mainly been with ecological reaction of foragers to the environment and resource distribution and with intrasocietal hierarchies within a group. Therefore, important issues such as intersocietal interplay among foraging groups have rarely been addressed. This research examines land-use strategy of Central-western Chulmun foragers and considers intersocietal competition and negotiation among groups in accessing resource patches. Examination of faunal assemblages from shellmiddens on the coast and small islands in the Korean West Sea (Yellow Sea) indicates that resource patches were accessed for specific target resources, while other kinds of resources were also available. Adopting this logistical strategy, late Chulmun foragers needed to access many patches to maintain a broad-spectrum subsistence economy. Stylistic analysis of ceramic assemblages from residential sites and limited activity stations suggests that, in order to have access to various patches, foragers of the Central-western Chulmun Period did not claim exclusive ownership on specific patches, but instead shared use-rights to these patches. Consideration of resource-patch sharing among foragers suggests that stable access to various resources are not merely given by environment, but in large part achieved by strategic intersocietal negotiation with other groups.

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**KIMPE, K., JACOBS, P.A. &  
WAELEKENS, M.**

*Identification of animal products in ancient ceramics of  
Sagalassos, Southwest Turkey.*

**Session:** Animal Fats and Oils

**Abstract:** Traditional techniques to identify animal derived food remains use the morphology of preserved bones. The former technique provides important information on the earlier environment, but is inefficient when organic remains are poorly preserved. The use of chemical criteria to identify the organic remains can solve these problems. Hereby amorf residues are identified using specialized analytical techniques. This opens interesting prospects for the research of encrusted remains in ceramic sherds found in archaeological excavation sites. The lipid extract of several types late Roman pottery from the archaeological site Sagalassos were analysed with gas chromatography (GC), liquid chromatography (LC) and mass spectrometry (MS). The identification of cholesterol with a GC coupled to a mass spectrometer (GC-MS) is a first indication of the use of animal products. Ruminant and non-ruminant products can be distinct through the detection of *trans*-vaccenic acid (C18:1 $\omega$ ) which only occurs in ruminant products. If the amount of stearic acid (C18:0) is larger than palmitic acid (C16:0) in the transesterified extract, it is possible to establish the presence of sheep or goat meat, as this is the only source of animal fat with such high amounts of stearic acid (1). The distribution of saturated triacylglycerols can additionally give an indication as to which animal fat was used. Saturated triacylglycerols are almost exclusively found in animal fats and

are less susceptible to alteration reactions (chemical and microbiological reactions), which changed the distribution of unsaturated triacylglycerols during the long burial period. The triacylglycerols can be identified and quantified with a high temperature GC and with liquid chromatography coupled to atmospheric pressure chemical ionization (LC-APCI) MS. With the latter instrument the use of animal fat in oil lamps was shown, while it was generally presumed that only olive oil was used as a fuel for these lamps. Also with mass-spectrometric methods beeswax was identified in some cooking pots.

Belitz and Grosh (1999). *Food Chemistry*. Springer-verlag Berlin.

**Keywords:** lipids, mass-spectrometry, *trans*-fatty acids, triacylglycerols, LC-APCI-MS

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**KNIGHT, S., CRAIG, R., HARDING, A., KNÜSEL, C.J. & OUTRAM, A.K.**

*Integrating the methods for studying unusual peri-mortem and ritual treatment of human and animal remains*

**Session:** Integrating Zooarchaeology

**Abstract:** Many prehistoric sites have features that contain assemblages of mixed animal and human remains that appear to have undergone a series of unusual peri-mortem and, possibly, ritual treatments prior to deposition. The detailed study of animal butchery has become relatively common and some spatial studies have been carried out on such material in order to elucidate the particulars of animal processing and distribution. Equally, exhaustive methodologies have been formulated to address complex behaviours such as cannibalism, as well as other funerary rites, from the study of human remains. However, there have been very few attempts to integrate the study of animal and human remains so that a proper comparison of the two can be made. This paper attempts to redress this omission by applying a single comprehensive methodology to the problem of identifying complex peri-mortem economic and ritual behaviours.

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**KORSTANJE, M.A.**

*Microfossils in Camelid dung: Taphonomical Considerations for the Archaeological Study of Agriculture and Pastoralism*

**Session:** Taphonomy

**Abstract:** Faunal spherulites are recognized to be microscopic round structures composed of calcium carbonates, formed mainly in herbivore guts. They were first described in European herbivores and carnivores' species and as fossil specimens from archaeological sites. The study of microfossil assemblages from dung is here proposed as a useful direction for understanding fertilizing practices in agricultural fields, from a multiple lines of evidence research. These micro assemblages may include - depending on the matrix and environmental conditions-, silica and calcium phytoliths, diatoms, crysophycean, micro charcoal, cellulose, spherulites, pollen and starch granules, among the most common ones. To value the possibilities of animal spherulites in such analysis, our first aim was to recognize if faunal spherulites were also present in South American camelidae dung and soils. Once this assertion was confirmed, dung pellets from the two domestic species (*Lama pacos* and *Lama glama*) and the two wild species (*Lama guanicoe* and *Lama vicugna*) from different environments were analyzed, morphologically characterized, and counted. Out of these, we observed that same specie might produce large quantities of spherulites or no spherulites at all. This problem is here explored both from the environmental conditions factors that might affect them -either in production or in preservation-, and from the quality of fodder the animals are ingesting. In addition, we checked how the protocols used for phytolith extraction from soils can possible damage the calcium spherulites. Other considerations and experiments about heating conditions and preservation on soils are included as well. This contribution pretends to show the importance and the limits of studying the faunal fecal spherulites in assemblages with grass phytoliths and other microfossils, from a taphonomical perspective, to investigate agricultural and or pastoral archaeological contexts.

**Keywords:** Archaeology, Camelidae, Faunal spherulites, Husbandry Practices

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## KOYAMA, S.

Keynote speaker

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

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## KOZDEBA, B

**Poster (and oral presentation):** *Did the competition between reindeer and red deer influence the changes in body size of these species during the Upper Palaeolithic? An osteometrical study.*

**Session:** General

**Abstract:** The osteometrical study give us the possibility to note fluctuations in the body size of reindeer (*Rangifer tarandus* L.) and red deer (*Cervus elaphus* L.) populations in Central and Eastern Europe during the Upper Palaeolithic. These fluctuations in size were caused by changes in both the abiotic and biotic components of their ecosystem. A number of biotic components have been investigated in this context. However, one component - interspecific competition - has only been rarely considered. The aim of this paper is to investigate the possible effects of competition on the body size of both species in areas where they occur sympatrically and to compare it with areas inhabited by only one of them. What happens with the body size if the different species compete for the same resources? Resource partitioning or elimination (replacement, displace) through the more effective species? Do the changes in population size, sexual dimorphisms or body size can help as to explain this problem?

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## KOZDEBA, B.

**Poster:** *The osteometrical investigation of Neolithic Red deer populations from Burgäschisee-Sud (Switzerland) and Svodin (Slovakia).*

**Session:** General

**Abstract:** Based on the osteometrical data I would like to attain information about sex ratio and sexual dimorphism of Neolithic red deer populations in Central Europe. This important information helps us to draw precise conclusions about the red deer exploitation strategy among Neolithic cultures. The red deer assemblages from two sites were analysed: Svodin in Slovakia, a

Lengyel and Baden culture site, and Burgäschisee-Sud in Switzerland, a Cortailod culture site.

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## KRÖNNECK, P.

*The avian fauna of the Troad - from the Neolithic to the Roman Period*

**Session:** General

**Abstract:** The Troad, with its most important site Troia, is part of the Biga Peninsula in the northwest of Turkey. It is in the south of the Dardanelles on the western end of the straits between the Aegean Sea and the Black Sea. The main parts of the Troad are the plateaus of tertiary sediments and the river floodplains. The latter were a large estuary at the end of the Ice Age. Since that time it has filled up with river sediments, so that since the end of the Roman Period we have the current situation. These environmental changes are well reflected by the avian fauna of different archaeological sites. Beside the waterfowl we can also find species of the drier habitats: rocky slopes and open grassland. These habitats show the early clearing of the indigenous forest. To illustrate the changing landscape and the different hunting patterns the results of Troia, Kumtepe and Besiktepe are discussed.

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## KRÖNNECK, P., NIVEN, L. & UERPMANN, H-P.

*Middle Paleolithic Subsistence in the Lone Valley of the Swabian Jura*

**Session:** Neanderthal ecology

**Abstract:** Since the work of Oskar Fraas in the 1860s the Lone Valley has been a center for Palaeolithic research. In the context of a session on the Middle Palaeolithic, the important excavations of Robert Wetzel and Gustav Riek are particularly noteworthy. The key sites containing Middle Paleolithic assemblages are Bockstein, Hohlenstein-Stadel, Hohlenstein-Bärenhöhle, Haldenstein and Vogelherd. While the precise dating of nearly all of the find layers is uncertain, most of the deposits appear to date to the Würm glaciation. Although the Middle Palaeolithic artifacts from the Lone Valley have been published in some detail, the fauna from these sites has largely been addressed from a paleontological point of view, and until recent

years little zooarchaeological data was available. New analyses of the collections from Bockstein and Vogelherd will form the main focus of this paper, while the fauna from the other sites will provide a broader base of comparison and will be used to help establish patterns of Middle Palaeolithic subsistence.

**Keywords:** Neanderthal, Middle Palaeolithic, Lone Valley, Germany

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#### **KROTOVA, O.**

*The bone inventory of the Upper Palaeolithic bison hunters in South Ukraine*

**Session:** General

**Abstract:** There are significant assemblages of bone inventory from sites with mono bison (Amvrosievka) and predominantly bison (Anetovka II) fauna in south Ukraine. Radiocarbon dates for the sites are between 18,000-19,000 B.P. The Amrosievka bone inventory consisted of 27 bone points that were either whole or represented by fragments. There were spindle shaped, from 7 to 37 cm in length, curved in profile, oval in cross section, sharp of both ends and the flattened points. Three of them had one or two parallel lateral groves. Most of them had lengthwise and parallel manufactured traces - planning and scraping by flint tools and polishing by soft material. There are cross or spiral thin cuts by flint tools on the shafts of pieces. The Anetovka bone and horn inventory consisted of ready-made and half-finished pieces of bones with initial manufactured traces. The group of ready-made pieces included weaponry tools - the points and a fragment of harpoon. The points consisted of 184 pieces either whole or represented by large fragments. Most of them were spindle shaped, from 5 to 23 cm in profile, round in cross section. The pieces had sharp points and sharp, splintered hafts. One of them had four parallel lateral groves. A separate group of tools consisted of some polishers and the awls, a hammer and two pendants of bear teeth. The bone and horn points were perhaps hafted for flint baked micro points. They are hunting projectile weapons. In addition, some flint tools in the sites assemblages bear micro traces suggesting their use for working on bones and horn. This is additional confirmation about the existence bone and horn technique at bison hunters' sites in south Ukraine.

**Keywords:** Upper Palaeolithic, south Ukraine, bison hunters, bone inventory, projectile weapons.

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#### **KUŽIR, S.**

**Poster:** *A Dog Mandible from the Eneolithic Site of Vuçedol (Croatia)*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Numerous branches of science (biology, veterinary science, cynology, archaeology, etc.) show great interest in the characteristics and development of approximate 370 (Veterinary Manual 1996) of the internationally recognized breeds of dogs (*Canis familiaris*). Over one third of the topics at the 8th ICAZ was dedicated to the origins and history of dog breeds, changes in their morphology and phenotype and the role of the dog as the first domesticated animal. Presently there are five Croatian internationally recognized (FCI) locally developed breeds of dogs: Posavac hound, Croatian sheepdog, Dalmatian dog, Istrian rough-coated hound and Istrian smooth-coated hound. There are many literature sources on dog breeds, but those on the early history of the central European breeds are lacking. Drawings on pottery and on the walls of houses as well as skeletal remains are the only evidences, but they have not attracted attention until recently. My intention was to collect as many facts about animals as possible, using the available osteological material. Of some 15,000 skeletal remains of the domestic and wild animals from the Vuçedol eneolithic excavation site near the town of Vukovar in Croatia, I selected canine mandibles pertaining to three cultural periods: Baden, Kostolac and Vuçedol (3400-2200 B. C.). Morphological and osteometric analyses were carried out and comparison with the corresponding recent skeletal material was made. Based on these findings it is assumed that the Vuçedol dogs were of similar size and weight to recent mid-size breeds. It may further be concluded that they were the link between the smaller dogs which had lived in the same localities during the Neolithic and the bigger ones of the Bronze Age.

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#### **LANGEMANN, G.**

*Zooarchaeological research in support of a reintroduction of Bison to Banff National Park, Canada*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Ecosystem managers are considering a reintroduction of plains bison to the backcountry of Banff National Park, in the Rocky Mountains of Canada. Bison were once a key species in

the foothills and the montane ecosystems, but they have been absent in the wild since their near extinction in the 1870's. Now, with ecological integrity a primary mandated responsibility for the national parks, researchers in a number of fields are addressing the question of how and where bison might successfully be reintroduced, in the context of larger questions of ungulate and vegetation management. Zooarchaeological research is part of this effort. Bison have been identified in the 10 000 year-old components in Banff, and are present throughout the archaeological record, although never in large numbers. In this paper, I summarize what we know about past distribution of bison in Banff over time and space, and about patterns of human use of ungulates. I also discuss some ways in which re-analysis of existing zooarchaeological collections, stable carbon isotopic analysis, DNA identification, and historic accounts are helping to give ecosystem managers a picture of bison ecology as it was in the long period before European intervention.

**Keywords:** bison, ecological integrity, restoration, Banff National Park, montane

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#### LAPHAM, H.

*Zooarchaeological Evidence for Changing Social Status within Historic Native American Communities*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Within decades of European settlement in the Americas, an overseas demand for leather imported from the New World led processed deerskins to rank the top most important commodity produced for colonial trade by southeastern Native American groups. The deerskin trade, which flourished in the seventeenth- and eighteenth-centuries (ca. A.D. 1600s-1700s) in southeastern North America, provided native peoples with new opportunities to acquire socially-valued goods through interregional exchange. In this paper I examine changes in how individuals and families achieved status within historic Native American communities. Comparative analyses of faunal remains and bone tool assemblages indicate that several changes occurred in seventeenth-century deer exploitation and hide production: the utilization of white-tailed deer increased, deer harvests became more selective toward animals whose hides would bring high exchange rates, and the processing of deerskins intensified for the purpose of hide production for commercial trade. These changes suggest that certain seventeenth-century Native American settlements chose to alter harvest and production activities in order to participate in a growing interregional trade in hides, furs, and nonlocal status goods. I argue that producing deerskin for commercial trade provided certain social groups with an effective way to enhance and strengthen their own position, power, and authority within the native community.

**Keywords:** Social Inequality, Interregional Trade, Prestige Goods, Eastern North America, Historic Period

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#### LAROULANDIE, V.

*Anthropogenic vs. non-anthropogenic bird bone assemblages: how can we distinguish them?*

**Session:** Taphonomy

**Abstract:** Bird remains in archaeological sites may have been accumulated by raptors, carnivores, people or may result from natural death. Therefore, it is crucial to determine the origin of archaeological bird bone assemblages for unraveling the significance of avifaunas for humans during prehistory. This paper deals with different approaches which seek to solve this problem. These approaches focus on information derived from spatial distribution, ethology, age, bone fragmentation, skeletal part representation, and bone marks. The relevance of each of these variables is investigated through the use of published data and a first-hand analysis of actual and archaeological assemblages in order to reconstruct the taphonomic history of bird bone assemblages. Unfortunately, the problem of equifinality plagues the discrimination of the various causal agents. As a result, a configurational approach is advocated.

**Keywords:** bird bones, taphonomy, methodology, actualism

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#### LAUWERIER, R.C.G.M. & de VRIES, L.S.

*Against the loss of archaeozoological information*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** One of the main organizational problems of archaeozoology is the safeguarding and making available of knowledge and information. In the every day practice it turns out that for several reasons a considerable part of the written information can not or hardly be retrieved. It is ironic that initially threatened archaeological heritage is rescued by an excavation, but subsequently, - after an investment of people and money - threatens to get lost again, because the results of the investigations, written down in reports and articles, are unknown and untracable.

This paper outlines the nature, extent and causes of this problem. The solution proposed for Dutch archaeozoology will

be discussed: an attending system with meta-information for archaeozoological information, 'BoneInfo', that can be consulted on internet.

**Keywords:** Grey literature, Meta-information, Internet, Archaeological heritage management, Archaeozoology

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### LEE, J.-J.

*From Fisher-Hunter to Farmer: Changing Socioeconomy during the Chulmun Period in Southeastern Korea*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** This study examines the processes of socioeconomic changes during the Chulmun period (6,000 to 1,000 B.C.) in southeastern Korea. The investigations are undertaken using the regional analysis of shell midden sites and the analysis of faunal samples in two areas: Pusan-Kimhae, and Kosong-T'ongyong areas. The results show that the Chulmun people in the areas seemed to have been successful fisher-hunters. They exploited both marine and terrestrial resources according to seasonal cycles. Due to environmental changes and/or population increase during the Middle Chulmun period, people in the areas experienced a certain degree of resource stress. The two research areas adopted different adaptive strategies. The Pusan-Kimhae area gave up marine resources rapidly and entirely shifted to terrestrial resources during the Late Chulmun period. In the Kosong-Tongyong area, the exploitation of marine resources was intensified by procuring more diverse species from more diverse habitats during the Middle and Late Chulmun periods. Then, the exploitation of marine resources was suddenly reduced during the following Mumun period. One of the major factors that allowed people to shift their subsistence to a terrestrial-oriented strategy was the cultivation of domesticated plants. The need to find a different procurement strategy initiated the use of domesticated plants in coastal areas, which was already practiced in northern and central Korea. The changes in subsistence strategy seemed to be closely related to the increasing social complexity. The Late Chulmun period was characterized by new forms of social and economic relations, such as the development of a long distance exchange system, emergence of specialized tool-making, and the possession of valuables. In the process of increasing social complexity, domesticated plants provided an excellent source of wealth accumulation.

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### LEGGÉ, A.J.

Discussant

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

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### LEGGÉ, A.J.

*The use of milk in prehistory; a review of some ideas.*

**Session:** Milk, Milking and Dairying

**Abstract:** In 1871 Canon Greenwell (of Durham cathedral) published his conclusion that the mammal bones found in middens at Grimes Graves (Norfolk, England) were indicative of intensive milk use in prehistoric times. Grimes Graves was further excavated in 1922-34, then again 1971-72 and further from 1972-76. Extensive Bronze Age midden deposits were found at each of these excavations; all having exceptional conditions of bone preservation. I have studied the mammal bones from three of these excavations, and the patterns found at each are remarkably similar. In 1981 I published the conclusion that Greenwell's interpretation had been right, and that dairying had been the primary motive in the cattle management at the site. This was based on a rather more extensive analysis of the evidence than Greenwell had made, emphasising the population age structure (a high proportion of neonatal and infantile calves were culled) and the proportion of the sexes surviving into the adult herd, which showed a bias towards females. A yet larger bone sample was published in 1992 which confirmed my earlier analysis in all details. Objections have been raised to this interpretation, each focusing upon one or more points in my interpretations. The objections have included (a) a supposed intolerance to the milk sugar lactose among Bronze Age peoples in Britain (b) the assumed reluctance of 'primitive' cattle to give milk and the inability of early peoples to delude them (c) the proposition that the mortality patterns found were the result of purely natural mortality and (d) that cattle populations could not be sustained with high infant mortality. The paper will review the original evidence and that from some bone analyses that have been published since. The objections that have been raised to the interpretation of prehistoric dairy husbandry will be discussed in the light of some recent research.

**Keywords:** Milking, Cattle, Prehistory, infant mortality, Sex ratio

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**LENTACKER, A., ERVYNCK, A. & VAN NEER, W.**

*Gastronomy or religion? Animal remains and the festivities around the mithraeum in Tienen (Belgium)*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The analysis of the animal remains found in a ritual pit located close to the 3rd century mithraeum (temple of Mithras) of Tienen (Belgium), yields indications about the symbolic meaning of certain species within the cult. Especially the presence of the remains of more than 200 cocks (male domestic fowl) can possibly be linked with the worship of the Sun, or with a symbolic dimension of other astronomical phenomena. Other species (jackdaw, eel) may have played a specific role within certain rituals. Of course, the animal remains from the pit also represent the leftovers from a rich banquet. Characteristic traces on the bones reveal that the animals were not only sacrificed (if at all), but also eaten. This rises the question whether the composition of the banquet was primarily determined by the symbolic meaning of the animals, within the cult of Mithras, or by the gastronomic preferences (and the purchasing power) of the invited guests. Comparison with the animal remains excavated at other mithraea, and at other religious sites within the western Roman Empire, enables to differentiate between both options. Finally, the bones recovered from the pit shed light upon the taphonomy of the structure. They corroborate that it was filled during one event, and even give an indication about the time of the year this happened. Moreover, traces on the animal remains show which cookery activities happened during the festivities, before the ritual filling of the pit. An important side question is how many people were responsible for the food leftovers. In other words, how large was the party that consumed more than 200 cocks, several piglets and lambs, some beef, salted Mediterranean fish, and a lot of fish sauce?

**Keywords:** Roman period, Northern Gaul, Mithras cult, ritual banquet, animal symbolism

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**LEOZ, E. & VANNOORENBERGHE, A.**

**Poster:** *Has ochre had uses other than colouring in the Early Gravettian at the Abri Pataud (Dordogne - France)? Contribution of faunal, lithics and ochre studies.*

**Session:** General

**Abstract:** Both Aurignacian and Gravettian levels of the Abri Pataud (Les Eyzies-de-Tayac, Dordogne - France) contains mineral colouring fragments : hematite and manganese. Early Gravettian (level 5, dated between 28000 and 29000 years B.P.) shows the most important quantity of ochre fragments found during H.L. Movius excavations in 1960 and 1961: 335 different places showing more than 500 fragments. The importance of the level 5 ochre concentration is obvious when we compare it to the rest of the Aurignacian and Gravettian levels which contains only 80 mineral colouring fragments. Among these ochre fragments, very few present use striations and abrasion marks to permit identification as 'ochre pencils'. We think that ochre was used especially in a pulverized form. Has ochre had, in this level, uses others than colouring? Level 5 is also the one which contains the majority of fox and hare faunal remains, showing butchering marks, and an important percentage of end-scrapers (nearly 19 % of total tools). We tried to link archaeozoological, lithic and ochre studies, in order to test the hypothesis of hide working during the Early Gravettian at the Abri Pataud

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**LEV-TOR, J.**

*African-American Slave Diets as a Response to Nineteenth Century U.S. Plantation Agricultural Production Systems*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Archaeologists working on nineteenth century southeastern U.S. plantations have focused their research primarily along the coastal areas and for the most part have confined their questions to a search for African-American ethnicity, and distinguishing the status differences between master and slave, or domestic and field slaves. Zooarchaeological studies have been a key to these studies. Yet that plantation research paradigm is narrow, and is in need of expansion, both in geography and in the approach to slave diets. This paper will compare and contrast zooarchaeological data gathered from plantation sites not only in the Atlantic coastal region, but also in the economically distinct upland interior of the southeast. The overriding theme guiding this comparison is to explain the differences visible in slave diets using a theory of risk, the idea that slaves faced risks in not having enough or

adequate food, and had to devise ways of minimizing it. The degree of risk for slaves varied according to the labor system used on the plantations; labor systems depended on the types of crops produced, which in turn was dependent upon the regional location of the plantation. One of the most important categories of dietary evidence employed here is the role that hunting and fishing played in slave communities – possibly one way to measure the need slaves had to supplement their supplied rations.

**Keywords:** Slaves; Labor and Dietary Strategy; Nineteenth Century; Plantations; United States.

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## LEVINE, M.A.

*mtDNA and horse domestication: the archaeologist's cut*

**Session:** Equids in Time and Space

**Abstract:** There is little argument amongst researchers that many questions conventionally regarded as archaeological - for example, hominid evolution, ancient diet, the origins of animal husbandry - cannot be resolved by purely archaeological methods. One approach to the problem is for archaeologists to become specialists in relevant fields - zoology, botany, soil science, and so on. Another is for specialists from various fields to work with one another - archaeologists, molecular biologists, geneticists, etc. For some problems, both strategies need to be employed. Although this seems terribly obvious, in practice this objective may be very difficult to achieve. Workers from different disciplines, such as archaeology and genetics, have to work under different constraints and often find, with the best will in the world, that it is sometimes impossible to present the results of a study in a format that will satisfy all the contributors. One way to get around this problem is to publish the results in a variety of formats. The geneticists' point of view for the project to be discussed here has already been presented (Thomas Jansen, Peter Forster, Marsha A. Levine, Hardy Oelke, Matthew Hurles, Colin Renfrew, Jürgen Weber and Klaus Olek, "Mitochondrial DNA and the origins of the domestic horse", in press). This paper will take the opportunity to discuss the results of that project from the point of view of the archaeologist.

**Keywords:** mtDNA, Horse, Domestication, Multidisciplinary approach

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## LEVINE, M., JEFFCOTT, L. & WHITWELL, K.

## *Palaeopathology and the evolution of horse husbandry*

**Session:** Beyond 'interesting specimens':

palaeopathology and its contribution to the study of animal husbandry

**Abstract:** Before the development of firearms, the horse was crucial to warfare and before the invention of the steam engine, it was the fastest and most reliable form of land transport. Today its importance in the undeveloped and developing world, including Eastern Europe, has scarcely diminished and even in the developed world it is of great economic importance to sport and leisure industries. Nevertheless, in spite of intensive investigations over many years, researchers know very little about the origins and evolution of horse husbandry and relatively little about the osteological consequences of riding and traction. The basic premise underpinning the palaeopathological approach is that the horse did not evolve in nature to carry a person on its back or to pull chariots and wagons. Until recently no systematic research had been carried out to investigate the consequences of this proposition. However, isolated empirical observations and anecdotal evidence, suggesting that the kinds and frequencies of abnormalities that we can expect to find in bones of wild horses differ from those of domesticated ones, inspired us to develop a more systematic methodology. The results of comparisons between skeletons of Exmoor ponies, Scytho-Siberian horses and Medieval horses do, indeed, strongly support our approach. The stresses associated with riding do differ from those connected with the horse's natural activities. Moreover, we were also able to show that certain types of back injuries could have been related to the type of saddle in use.

**Keywords:** horse, palaeopathology, domestication, saddle, Scytho-Siberian

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## LIGHT, J.

*Marine mussels - wear is the evidence.*

**Session:** Archaeo-Malacology

**Abstract:** Marine mussels (*Mytilus* spp.) are common components of shell assemblages from archaeological sites worldwide and this reflects, inter alia, their palatability, wide zone of intertidal distribution and potential for exploitation during a major interval within the tidal cycle, and their widespread global distribution. On rocky shores, no bivalve is



commoner: they occur in dense masses as layers of animals united by interwoven byssal threads, and tolerate exposed rocks and sheltered shores. At a Romano-British site at Fistril Bay in north Cornwall large numbers of mussel shells were retrieved from midden deposits, together with limpets (*Patella* spp.) and smaller numbers of dog whelks (*Nucella lapillus*). Whilst the limpets and dog whelks were in an excellent state of preservation - favoured by the calcareous windblown sands which sealed the site - the mussels were fragmented, flaky and many bore highly abraded and faceted surfaces in their umbonal region and immediately above. These extreme wear patterns were initially interpreted as evidence that the shells had been employed for some utilitarian purpose; as tools for buffing or burnishing processes, for example. Examination of the local mussel colonies in the modern day environment has revealed the agent of abrasion to be the combined forces of extreme wave action exacerbated by suspended sand, the flexibility of the byssus by which the mussel attaches to the substrate, and the densities of the mussel colonies attached to the littoral rock outcrops. Where mature mussels are crowded and their substrate for attachment is constricted further by successive mussel recruitment episodes, wave action jostles the mussels causing them to abrade against each other and the underlying rock. An understanding of the ecology, habitat and potential source of marine mollusc shells is clearly advantageous in distinguishing between natural processes and the hand of man when analysing modified shells from archaeological sites.

**Keywords:** Mytilus, middens, abrasion, Romano-British, Cornwall

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## LIM, S.

*Differences in the Uses of Sea Resources and Their Socioeconomic Implications: A Comparison between Late Chulmun South and Central-West Coasts of the Korean Peninsula*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** This research examines the differences in uses of sea resources between south and central-west coastal areas of the Korean Peninsula during the late Chulmun Period (3000-1300 BC). The two areas show remarkable differences in strategies for sea-resource use. Shellmiddens of south coastal are characterized by their large sizes, diversity in faunal assemblage, and diversity and large sizes of stone/bone tool assemblages. In contrast, simple faunal assemblage (dominated by oyster) and smaller size of stone tool assemblages characterize those of central-west coastal area. Therefore, it is suggested that shellmiddens of south coastal area were (seasonal) residential bases with higher degree of sedentism, while those of central-west coastal area were temporary campsites for food procurement. These differences are related with the difference between the two areas in the degree of dependence on sea resources and in adaptations in

previous period. In south coastal area shellfishes and sea mammals were continuously exploited. In contrast, not having actively exploited sea-resource during previous period in central-west coastal area, hunter-gatherers of this area mainly exploited oysters, which are relatively easy to procure with no innovations of procurement technology and of artefact manufacturing. These different uses of sea resources between the two areas are also related with differences in economic role of sea-resources: in south coastal area sea resources continuously played an important role in subsistence economy, while in central-west coastal area shellfish gathering was added to the previous subsistence economy that had been heavily dependent on hunting and gathering of terrestrial resources and some degree of incipient plant cultivation.

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## LINSEELE, V.

*Status and consumption of dog in western Africa*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Archaeological research by the University of Frankfurt (Germany) in the Sahel zone of Burkina Faso has yielded the first chronological sequence for that region. The oldest sites found date from the end of the Late Stone Age (2000-1000 BC), but their cultural deposits are limited and contain few animal remains. Most sites are from the Iron Age (0-1400 AD) and consist of settlement mounds with stratigraphic sequences of up to eight metres thick, rich in faunal remains. The appearance of the first domestic animals (goat, sheep and cattle) coincides with the beginning of the Iron Age. From then on, they dominate the faunal assemblages, but the practice of hunting, fishing and fowling persists throughout the complete sequence. On all Iron Age sites dog bones were found, but in the Late Iron Age (1000-1400 AD) they become remarkably numerous. As they were all fragmented and found among consumption refuse, the dog bones most probably represent food remains. The presence of cutmarks and traces of charring supports this hypothesis. Indications of cynophagy have also been found at other West African sites. Historical and ethnographical sources moreover confirm the existence of this practice in the region in both past and present. Dog eating seems to have appeared in West Africa at a time when (Transsaharan) trade increased. It will therefore be discussed whether or not cynophagy was introduced by or through a foreign ethnic group. The ritual and religious meaning of the practice today and its association with certain social groups within a community will be elaborated as well.

**Keywords:** Burkina Faso, Late Iron Age, cynophagy

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**LOPONTE, D. & ACOSTA, A.**

*Integrating zooarchaeology from Pampa and Patagonia, South America*

**Session:** Integrating Zooarchaeology

**Abstract:** The main focus of zooarchaeological research is still the reconstruction of past human diet, even though many other specialized fields have been developed. This emphasis, though dating back in time within archaeology as a whole, has intensified research in our discipline during the last four decades of the 20th century. Concurrently, in the last 30 years, archaeologists have seen the need to actively incorporate taphonomic studies in order to reconstruct more precisely certain aspects of archaeofaunal assemblages. However, researchers in the last 25 years have found that isotopic analysis is also invaluable in determining specific aspects in dietary analysis. This is a complement to traditional zooarchaeological analysis and reduces some of the inherent equifinality. The addition of methods such as phytolith analysis of dental enamel and palaeopathology are also necessary when evaluating past human diets. This paper draws on examples from hunter-gatherer sites in the Pampas and Patagonia to show how zooarchaeological research is being integrated in Argentina

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**LOPONTE, D., ACOSTA, A. & MUSALI, J.**

*Fishing and Social Complexity among Hunter-Gatherers in the Pampean Region, Argentina*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** This paper focuses on the complexity of late Holocene hunter-gatherers in the wetland located in the lower Paraná river and Río de la Plata between 1100 and 500 YBP. Fishing was the most important subsistence activity. We discuss the relation between risk and uncertainty of the environment, the complexity of the archaeological record and the importance of riverine fishing.

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**LÕUGAS, L.**

**Poster:** *Fish and seals in a prehistoric perspective*

**Session:** General

**Abstract:** Fish and seals were the main resources that attracted people to settle in the coastal area and islands. The Baltic Sea offered different amounts and species (quantity and quality) of water animals during its postglacial history. There have been freshwater, brackish water and salt water stages during the formation of this sea. The diversity of fauna was bigger during the salt water stage and the 'marginal effect' in coastal zone was intensively used by people. The poster presents an overview of the development of fish and seal fauna in the Baltic from the Late Glacial to the present times. This interdisciplinary study is based on subfossil bone remains found from the archaeological sites and natural marine deposits. The geological background of the Baltic Sea, i.e. four post-glacial stages, is shown on the maps. Immigration routes of water animals were described using the data of geology and palaeoenvironment.

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**LÕUGAS, L., ERIKSSON, G. & LIDEN, K.**

**Poster:** *Stable carbon and nitrogen isotopes as dietary indicators applied to prehistoric populations from the Baltic region*

**Session:** General

**Abstract:** Stable carbon and nitrogen isotope measurements on collagen from ancient human, as well as animal, bone have been used to determine the sources of protein in ancient diet in many parts of the world including the Baltic area. The complicated natural history of the Baltic Sea can however, cause a problem since the varying marine influence affects the isotopic signature, i.e., the marine end-value. The method is albeit applicable in this area as long as an end-value is determined at the specific time period of interest. The transition from one subsistence to another during prehistory can be detected as transitions in the diet. A transition in diet can be defined as a change in the total amounts of food consumed or a change in frequency of the different resources included in the diet. The importance of dietary transitions is not only because of the transition per se but also because of its significance to other factors determining our lives, such as economy, health, demography, social complexity, etc. Transitions in diet can be studied on several different levels, i.e., between populations, within populations, between individuals but also within an individual. By the use of different tissue we can study changes over an individual's life. Stable carbon and nitrogen isotope analyses can be applied in both human diet investigations and in the study of (pre-)historic faunas. We have studied pigs, dogs, seals, etc. at coastal sites together with people from the same sites who got their subsistence from the sea. Here we find interesting differences in

diet between humans and dogs. In the study of migrating animals, these analyses are also useful.

**Keywords:** stable isotopes, diet, prehistoric populations, Baltic region

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## LOUGUET, S.

*Determining the age of death of Proboscids and Rhinocerids from dental attrition*

**Session:** Ageing and Sexing

**Abstract:** Archaeological deposits producing a great deal of Proboscidean and Rhinocerotidae remains with lithic vestiges from Hominids occupations are not rare in Europe from the Pleistocene era. Taphonomic and zooarcheological studies of these remains inform us about the animals' treatment. However, it is not as easy to determine the acquisition methods of these large herbivores by prehistoric humans. The difficulty we face when examining such bone assemblages is to know if these deposits are the result of hunting or from scavenging from naturally dead animals, or victims of predators others than Hominids. Consequently, it is useful to identify the age of death of each individual from the fossil populations concerned by applying the dental attrition method. Specifically for the Proboscids with six cheek teeth per half-jaw alternating all through their life, it is simple, by adding the wear level, to determine the age of death of each individual. The method becomes more complex for Rhinocerids that can show concurrently six teeth per half-jaw, but the wear level of each one differs according to its position in the dental series. The method consists of measuring the height of each tooth in order to attribute to it an attrition state, and then indexing for each series the wear level corresponding to each tooth. Thus, eight ages intervals can be defined. This method represents the preliminary stage of reconstructing mortality profiles, which, included in a global study, will allow us to interpret them, either in term of natural mortality, of catastrophic massive mortality, or of selective hunting.

**Keywords:** proboscids, rhinocerids, dental attrition, age determination

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## LUBINSKI, P.M.

**Poster:** *Rabbit hunting and bone bead production at a late prehistoric camp in Wyoming, U.S.A.*

**Session:** General

**Abstract:** Rabbit bones, especially cottontail (*Sylvilagus* sp.), are common constituents of faunal assemblages in the Wyoming Basin (Rocky Mountains, U.S.A.), occurring in over 70% of 107 reported assemblages. They also numerically dominate identified NISP at more sites than any other taxon, including artiodactyls like bison and pronghorn. Nonetheless, sites with large rabbit assemblages are rare. The 'Raptor' site stands out in the region for its large number of rabbit bones as well as fragments of bone bead production waste. Excavations at this single component site dating 1330-1210 RCYBP yielded over 12,000 faunal specimens, principally rabbit or rabbit-sized bone fragments, including a minimum of 65 individual cottontail rabbits. This cottontail assemblage is three times the size of any previously reported in the study area. The worked bone assemblage includes 108 rabbit and rabbit-sized specimens of bead production waste, primarily articular ends of tibiae, humeri, and metapodials exhibiting a transverse cut made by the 'groove and snap' technique. The objective of the production appears to have been tubular beads 10-45 mm long. Similar bone bead production waste has been found at other sites in the Intermountain West, but in smaller numbers.

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## LUCAS, G.

*The rise of the United States meat-packing industry as seen from Charleston, South Carolina.*

**Session:** General

**Abstract:** In the eighteenth and nineteenth centuries, a nationwide meat-packing industry emerged in the United States. This mechanized industry developed the capacity to economically raise livestock, process carcasses, and ship meat over great distances. Archaeological and historical evidence from Charleston, South Carolina indicates that residents consumed non-local meat, while continuing to consume meat from local livestock. Evidence also indicates that these two sources of meat can be distinguished by the butchering methods, namely the use of the techniques of hacking and sawing, as well as by the body portions represented in the faunal assemblages. Data derived from cow and pig specimens recovered from three households in Charleston indicate differential utilization of local and non-local meat sources by different households. This evidence provides a greater understanding of household economy and status, as well as the large-scale meat economy of Charleston.

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## LYNCH, A.A. & WHITLEY, T.G.

*Enhancing Zooarchaeological Interpretation with Faunal Analysis System (a multifaceted data management and analytical program).*

**Session:** General

**Abstract:** Faunal analysis using the traditional means of paper forms and hand calculations is a time-consuming and error-filled process. Advances in computer technology over the years have resulted in our ability to compile, compare, and calculate data at a more rapid pace with a higher level of accuracy. The drawbacks of using standard off-the-shelf computer database software though have been issues of compatibility and the lengthy queries and calculations which need to be tailored to specific projects. In response, many archaeozoologists have attempted to develop specialized applications that make the task easier for themselves. This has largely come into fruition as standard datasets, useful for quick-key entry of scientific species names and associated biomass values (etc.). Until now, though, there have been very few stand-alone applications specifically designed for the entire process of faunal analysis. The Faunal Analysis System (FAS 1.0) software is a shareware database application that provides powerful tools for compiling (such as quick-key entries of species lists, bone attributes, and modifications, etc.), comparing (such as tools for project/site data management, provenience sorting, data export to other applications, and quick reporting and printouts, etc.), and calculating data (such as customizable one touch buttons for NISP, MNI, Weight, Biomass, Species Lists, Modifications, Fusion and Summary Tables, etc.). In addition, the management of faunal datasets with FAS will allow rapid linking to GIS spatial data for understanding density and distribution of such assemblages. More detail will be provided on the nature and operation of FAS in this presentation.

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## LYUBLYANOVICS, K.

**Poster:** *Stature, age and sex: size variability in Roman Period horses from Hungary*

**Session:** Ageing and Sexing

**Abstract:** The discovery of three complete horse skeletons near the AD 2nd-3rd century Roman auxiliary fort at the site of Albertfalva (Budapest, in the former province of Pannonia) offered an opportunity for studying three possible sources of size variability in the long bones of this species: age, sex and phenotype. A comparison with other Roman Period horse finds showed the apparently large stature of these animals with withers height estimations of 150-160 cm, a respectable size even by modern standards. A source of phenotypic size variability may have been the impact of "indigenous" Celtic stocks (smaller animals that survived Roman occupation in the area), as well as a result of the import of large, "western" type horses from Italy or other provinces of the empire. A proper

evaluation of size, however, is not possible without attempting to consider the animal's ontogeny and sexual dimorphism, the latter being rather poorly expressed in the morphometry of horse bones.

**Keywords:** horse ontogeny, sexual dimorphism, phenotypic size, Roman period horses, Central Europe

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## MackINNON, M.

*Bones, text and art in Roman Italy*

**Session:** Integrating Zooarchaeology

**Abstract:** Three principal sources of data provide information about animals in antiquity. References to animals in ancient texts furnish written accounts and descriptions. Depictions of them from ancient art yield visual images, while the analysis of their bones recovered from archaeological sites supplies further data about the actual animals themselves. Integration of these three sources of data is essential to form a complete understanding of the role of animals in antiquity and to recognize the strengths and shortcomings associated with each source. This paper outlines an approach to the integration of bones, text, and art using the pig in Roman Italy as an example. Pigs were important animals to the ancient Romans in Italy. Linking the zooarchaeological, literary and artistic data about them shows the presence of at least two breeds—a large, fat, short-legged variety and a small, bristled, long-legged variety. Zooarchaeological data confirm that the smaller breed figured more prominently as a source of meat in the Roman diet. The texts suggest that this breed was kept in herds and pannaged in the forests for food. The larger breed, however, seems to have been raised in a different manner, being stall fed, and in much reduced numbers compared to its smaller equivalent. Moreover, because of its grand size and the message of social and economic prosperity, which with this quality is associated, this larger breed predominates among artistic depictions of pigs in Roman visual culture.

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## MackINNON, M.

*In Sickness and in Health: Care for an Arthritic Maltese Dog from the Roman Cemetery of Yasmina, Carthage, Tunisia*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The special bond shared between humans and their pet dogs is not only a factor of modern times. The recovery of a canine skeleton - likely that of a small Maltese lap dog judging by stature estimates (withers height of approximately 22 cm) and extreme brachycephalic structure - from the Roman necropolis of Yasmina, in Carthage, Tunisia, provides convincing proof of the extraordinary care humans bestowed on this animal. The dog accompanied the inhumation of a child, and dates to approximately the 3rd century AD. Its skeleton is riddled with pathological conditions. Heavy calculus deposition had exacerbated the onset of periodontal disease and dental abscessing, which ultimately led to antemortem loss of all teeth, save the mandibular 1st molars. Marked alveolar resorption indicates that the animal survived for a long time without the bulk of its dentition; it probably was fed soft and processed foods as it could not chew effectively. All limb articulations are disfigured due to osteoarthritis. Both eburnation and porosity are noted on most articular surfaces, while exostoses surround the periphery of the joint margins in many cases. The medial shift of the left humerus has stimulated excess bone deposition around the glenoid fossa of the left scapula, while a definite dislocation is noted in the case of the right femur, which has shifted from the original pelvic acetabulum to form a totally new acetabular pit. Osteoarthritis also affects the vertebral column. In several instances the degree of osteophyte formation here is so marked as to cause fusion of ribs to vertebrae. Given the fact that this dog survived to an elderly age with such a suite of pathological conditions - and many of these at advanced stages - suggests that it received great care from its provider.

**Keywords:** Paleopathology, Maltese dog, Roman Carthage, osteoarthritis, animal care

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## MAGNELL, O

**Poster:** *Ageing of wild boar (Sus scrofa): An analysis of intra- and inter-population variations in tooth wear*

**Session:** Ageing and Sexing

**Abstract:** The study aims to investigate the use and limitations of ageing of wild boar based on tooth wear. The variation of the degree in tooth wear at different levels in populations of wild boar from Sweden, Poland and Germany has been analyzed. The frequency of uneven wear of individual dentition is studied as well as variations between individuals in the same age classes. Finally, variations in the degree of wear between different populations are investigated.

**Keywords:** wild boar, tooth wear, suids, dental attrition, age determination

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## MAINLAND, I.

*The diet and management of domestic animals at Neolithic Makriyalos*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** Dental microwear analysis, the examination of microscopic tooth wear patterns, is now widely used in palaeodietary reconstruction. Although largely focused on the diet of hominids and primates, microwear analysis has also been applied to other mammalian species within both palaeontological and, more recently, archaeological contexts. This paper will first briefly review the potential of dental microwear analysis for exploring questions relating to the management and provision of grassland and fodder resources for domesticated animals within an archaeological context before considering a particular archaeological application, specifically the elucidation of caprine and suid husbandry practices at the Late Neolithic site of Makriyalos, a 'non-tell', extensive village settlement in Pieria, Northern Greece. Two phases of occupation were identified at Makriyalos (Makriyalos I and II) both of which have been dated to the Late Neolithic period (ca. 5400/5300 BC to ca. 4700/4500 BC). A typical 'Neolithic package' of animals was present throughout the Neolithic occupation of Makriyalos, including, sheep, goat, pig and cattle (Halstead pers comm.). Analysis of microwear patterning has focused on sheep, goat and pig mandibles recovered from deposits within a large pit feature, thought to have accumulated as result of consumption events such as feasting, and from general habitation layers dating to the pre-Dhimini period of Neolithic occupation (Makriyalos I).

**Keywords:** Dental microwear Diet Sheep Goat Pig Neolithic

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## MAKOWIECKI, D.

*Population of dogs in the Roman Period in Poland and its ritual significance.*

**Session:** General

**Abstract:** In the Polish area, burials of dogs are discovered on some settlement and temple contexts from the period of Roman influence. Their cultural significance and symbolic character were considered from an archeological point of view (Andralojc 1993). But still archaeozoological research was missing. This report presents some considerations on dogs in the research area. The skeletons more than 100 dogs from the Kuyavia region are the basis for osteological research. Evaluation of sex, age at death and description of pathological changes were recorded as well. On the basis of archaeozoological data, the cultural significance of dogs in the Polish area in the Roman period will be considered.

Andralojc, M. 1993. The Phenomenon of Dog Burials in the Prehistoric Times in the area of middle Europe. Ollodagos. Societe Belge D'Etudes Celtiques.

**Keywords:** Dogs Burials, Archaeozoology, Roman Period, Kuyavia, Poland.

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## MALDRE, L.

**Poster:** *What did the Bronze Age dogs eat? A coprolitic analysis.*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The Asva fortified settlement is situated in the South-East of Saaremaa Island, West Estonia. This settlement is located on the eastern part of a ridge by a former bay. Archaeological excavations in Asva were carried out in 1938-1939 (directed by Richard Indreko), 1948-1949 (by Artur Vassar and Marta Schmiedehelm) and 1965-1966 (by Vello Lougas). Asva fortified settlement is dated to the Late Bronze Age (10th-7th centuries BC), but there were also finds dating from the Iron Age. In this paper only the dog's coprolites will be analysed, collected during the excavations in 1939. These coprolites contain a lot of bone fragments, including well preserved phalanges and other small bones of small ruminants, and fish bones, especially vertebrae.

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## MALTBY, M.

*Salt and animal products: linking production and use*

**Session:** Integrating Zooarchaeology

**Abstract:** Zooarchaeology has developed as a specialised sub-discipline of archaeology. Whilst zooarchaeologists will justifiably claim that they have contributed a great deal to our understanding of past societies, their contribution to recent theoretical debates has often been passive. The organisation of archaeology often results in many specialists working in isolation. Effective archaeology requires the expertise and ideas of specialists to be integrated. This introductory paper will look at the production and use of salt as an example of how such an integrated approach could stimulate new insights. Evidence for the large-scale production of salt is extensive from the later prehistoric period onwards. Hallstatt, Austria was situated to exploit salt. Ostia was originally developed to exploit coastal salt beds. In Britain, excavations have shown that salt was

extracted since prehistoric times in areas such as the Fens and the East Anglian coast. Salt trade was extensive. The Via Salaria was one of the roads to Rome. In Britain, extensive studies have been carried out into the production and distribution of ceramic salt containers. Although much of this salt must have been destined for use in the processing of meat and other animal products, there has been relatively little discussion by zooarchaeologists about the use of salt. This paper will note some exceptions to the above, notably evidence from shipwrecks and discussions of medieval and later processing of fish. In addition, it will argue that we need a more integrated approach to examine the impact of increased salt production in earlier periods. To do this we need to be aware of what materials and resources are required for salting meat, for example. We also need to consider implications that significant increases in the use of salt in food and leather production may have had on human societies.

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## MANASERYAN, N.

**Poster:** *Armenia: mammals from the Neolithic-Eneolithic settlements*

**Session:** General

**Abstract:** Animal bone remains discovered in Neolithic settlements of Armenia (5-4 millennium BC) are of great interest for studying mammalian fauna of Neolithic period in Armenia, which is still little known. During the excavation of a Neolithic settlement in Armenia more than 3000 bone fragments were recovered. Due to a high degree of fragmentation only 35% of the remains could be taxonomically identified. The study of archaeological sites revealed only 58 bones of wild animals belonging to 10 species (mammals). The following species have been identified: *Canis lupus*, *Vulpes vulpes*, *Ursus arctos*, *Martes foina*, *Sus scrofa* and *Cervus elaphus*, *Ovis ammon*, *Capra aegagrus*, *Cazella subgutturosa*, *Equus hemionus*. The domestic animals include cattle, horse, sheep/goat, pig and dog. Bones of sheep and goats were found at archaeological sites in great numbers (25-30% of all bone remains). Goat bones are less in quantity than sheep bones (1-4 to 10). The majority of bones belongs to very young animals with sheep and goats mostly (about 2/3) killed at an early age (not more than 1,5 years old). Judging from the presumed live weight of the farm animals, bovines (60-70%) and sheep (30-40%) were the main food for the Armenian people. Over 2800 bone remains of mammals are studied from of 12 Eneolithic settlements (end of 4th/beginning of 3rd millennium BC). The ratio between wild and domestic animals does not differ essentially from the monuments of Neolithic period. Domestic animals are represented by all main species, such as: oxen, sheep, goat, horse, pig, dog.

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**MANASERYAN, N.**

*Hunting equipment and objects in rock art motifs*

**Session:** General

**Abstract:** Cave and rock carvings discovered in Armenia in the 70-ies form a kind of 'temples' of ancient art, where the ideas, thoughts, images, rituals and aims of the primitive population are expressed in the 'language' using 3-4 thousand human and animal pictures. This study is based on rock carvings in the Gegham mountains and Siunikrefers. The subjects are mainly animals. It is worth noting that among the 675 analysed pictures only 18 lack animal images. Multiple observations of pictures indicate that the ancient artists were especially fond of hunting scenes. There are a number of single figures of Bezoar goats, bulls, deer, and other herbivorous animals. The rock carvings are mainly devoted to hunting. The hunters are armed with bows and arrows, spears, shields of rectilinear and curved form, and ropes for binding animals' legs, and sometimes horns. In collective hunts the beaters and shooters often used horses and dogs as participants in hunting. There are many scenes in which deer and goat are pursued by leopards. The latter has been used as a hunting animal since early times. Scenes of magic, very important for providing plenty of animals and successful hunting, are of special interest. Thus the rock carvings reflect the real world of the hunters and shepherds real world in the distant past, and tell us about hunting details and equipment, the different weapons used, as well as about the wild animals that were hunted.

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**MANCONI, F.**

**Poster:** *The use of cattle in prehistoric Sardinia from the evidence of bronze statuettes*

**Session:** Integrating Zooarchaeology

**Abstract:** The bronze statuettes that portray animals are part of a larger production of these objects, which was undertaken in Sardinia from the late Bronze Age to the early Iron Age. This is represented, among others, by warriors, priests, offerers, ordinary people, models of nuraghi and votive boats. Cattle are the most commonly represented animals, which is not surprising as they played an important role in the local economy, as also attested by the faunal analysis. Two of the cattle figurines are of particular interest, as they provide a clue about the use of these animals. The first concerns a team of oxen at the yoke, and portrays what probably was one the most common uses of these animals across the prehistoric world. The second statuette depicts a man riding a cattle. This unusual, and apparently strange, representation might be regarded as an oddity. However, surprised accounts of geographers, naturalists and travellers of the 19th century record the use of cattle for riding and as beasts of burden in that period. There is also a 19th century painting portraying a man riding a cattle. It is therefore possible that this

tradition could date back to the prehistoric period, although it is difficult to find a confirmation in the zooarchaeology record. The hypothesis would probably be strengthened by a confirmation that equids were rare or absent in prehistoric Sardinia. If this was indeed the case, it is plausible that cattle might have been used for a purpose that elsewhere was generally associated with horses and donkeys. Recent zooarchaeological work has confirmed the absence of equids in prehistoric sites in Sardinia, but there are still too few studied assemblages in order to be confident that this was really the case. However, there is plentiful evidence that horses and donkeys had become common and widespread by Roman times.

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**MARCH, R.J. & LUCQUIN, A.**

*Under-Cooking and Firing: Chemical Analysis of Fat Residues from Experimental and Archaeological Data*

**Session:** Animal Fats and Oils

**Abstract:** This paper is a synthesis of our work about cooking, firing and conservation of animal fat in different conditions and environments. We show our experimental results for different kinds of cooking methods and compare with archaeological data from different archaeological contexts, especially hunter-gatherer Holocene and Pleistocene sites from South America and Europe. We present results of fat analysis from, *Lama guanicoe*, *Otaria flavescens*, *Bos taurus*, *Ovis aries*, *Equus caballus*, *Equus ferrus* and *Salmo salar*. We analyse different kind of cooking procedures like roasting, boiling or fire stone cooking. Finally, we critically analyse the evolution of our points of view about analytical and experimental work during the last fifteen years and our future perspectives.

**Keywords:** Experimentation, Animal Fats, organic chemistry, cooking, fat conservation

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**MARCINIAK, A**

*Social changes in the European Neolithic. Taphonomic perspective.*

**Session:** Taphonomy

**Abstract:** The objective of the paper is to recognize the social dimension of relations between humans and animals, food acquisition and consumption as well as refuse disposal practices of early Neolithic farmers by contextual analysis of animal bone assemblages from their settlements. The major part of the advocated research procedure comprises study of the taphonomic history of these assemblages and is supplemented by interpretation of the horizontal distribution of faunal remains in relation to other categories of archaeological data. The example of the Band Pottery Culture assemblages from Kujavia, Central Poland, is provided.

**Keywords:** Poland, Band Pottery Culture, Neolithic, contextual analysis, social relations

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**MARTI-GRÄDEL, E., DESCHLER-ERB, S., HÜSTER-PLOGMAN, H. & SCHIBLER, J.**

*Early evidence of economic specialisation or social differentiation: a case study from the neolithic lake shore settlement Arbon Bleiche 3 (3384-3370 BC) at Lake Constance (Switzerland)*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** The neolithic lake shore settlement Arbon Bleiche 3 was founded in 3384 BC (datation by dendrochronology) and abandoned fifteen years later after a conflagration. In the excavated area (1100 m<sup>2</sup>) – probably half of the former village – 27 houses were identified. The settlement belongs to the transition period of the Pfyn and Horgen cultures. Both cultural traditions left their marks in the archaeological material. Some ceramics show a connection to the Boleráz Group (Baden Culture). The site has yielded over 40000 determinable bones. Domesticated animals (represented by cattle, pig, sheep and goat) and hunted animals (mainly represented by red deer) were equally important for the subsistence. The bone compositions of the houses show considerable differences (basis: relative number of bones and number of bones per squaremeter and years of occupation). Regarding the bone weight cattle are most frequently represented among the domesticated animals in every house, but there are considerably higher amounts of pig bones in the houses of the southern part than in those of the northern part of the village. The distribution of the fish bones indicates a same separation within the village by showing clearly higher amounts of coregonid fishes in the houses in the southern part. Some houses have yielded high amounts of wild animal bones – red deer in general, but also of certain wild species such as aurochs, bear or smaller fur animals. The described distribution patterns remain the same during the time of settlement and are not related to the chronology of the buildings. The taphonomic analyses of the bones make clear that the differences of the bone compositions cannot be explained by different sedimentation or preservation conditions. The differences between the bone compositions must be the result of different diet traditions, of social differences or of economical specialisations.

**Keywords:** neolithic period, lake shore settlement, Switzerland, socio-economical differentiation.

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**MARTIN, C.**

*Study of a shell-midden in the sultanate of Oman: the excavation of Suwayh 1 (SWY1)*

**Session:** Archaeo-Malacology

**Abstract:** Suwayh 1 is located along the coast of Oman, just 500 meters from the sea, near a sebkha. This site was a seasonal occupation of hunter-gatherers during the 6th and 4th millennium B.C., mainly composed of shell and fish bones. The shells analyzed in this work came from 28 archaeological levels discovered in a trench. More than 100 species were found in each level. The species present in SWY 1 indicate 4 different biotopes:

Lagoon: *Marcia marmorata*, *Marcia opima* and *Amiantis umbonella* (Bivalvia: Veneridae)

Mangrove: *Terebralia palustris* (Gastropoda: Potamididae)

Rocky shore: *Thais lacera*, *Thais tissoti* (Gastropoda: Thaidinae), *Noetiella chesneyi* (Bivalvia: Noetiidae), *Lunella coronata* (Gastropoda: Turbininae)

Sand beach: *Cypraea* sp. (Gastropoda: Cypraeidae)

The lagoon was the principal biotope exploited during the occupation of this site. During the ancient level, *Marcia marmorata* was collected but progressively, this species disappeared and was replaced by *Amiantis Umbonella*. This change can be explained by an overexploitation of *Marcia marmorata* and maybe by a change in the lagoon environment. The study of the shellfish assemblage of SWY 1, indicates a collection in 4 different biotopes mainly in the lagoon with the presence of 2 species *Marcia marmorata* and *Amiantis umbonella*. The rocky shore is the second exploited area with 2 different zone of waves exposition. This information allows us to highlight the relation between the human exploitation and the environmental changes in the lagoon.

**Keywords:** Archaeo-malacology, Environment, Oman, Lagoon, Mangrove

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**MARTIN, T. & BRASHLER, J.G.**

*The development of prehistoric fisheries in the Upper Great Lakes region of North America*



**Session:** Integrating Zooarchaeology

**Abstract:** Analyses of animal remains from prehistoric archaeological sites in southwestern Michigan have revealed the significance of a late spring/early summer fishery that focused on lake sturgeon (*Acipenser fulvescens*). Exhibiting new ideas about social organization, mortuary customs involving burial mounds, and specially crafted artifacts made from exotic materials, Middle Woodland period (ca. 250 BC-AD 500) populations have long been the focus of speculation involving the subsistence economy that was required to support this new level of sophistication. Forty years ago, Charles Cleland distinguished a fishing-hunting complex in the poorly-drained Saginaw Valley in eastern Michigan and an agricultural-hunting complex in the Grand River valley of southwestern Michigan. Recent field investigations in both areas have greatly increased the number of archaeological sites and collections of plant and animal remains that have a bearing on this topic. Key to understanding these societies are considerations of (1) the local reliance on horticulture, (2) the role of aquatic resources, and (3) the development of unique regional fisheries. Although horticulture did not become important anywhere in the Great Lakes region until the Late Woodland period, significant differences in fish exploitation are apparent. Unlike the mixed conifer-deciduous forests of the northern Great Lakes where the "Inland Shore Fishery" developed with a sophisticated gill net technology to exploit deep-water fish in open water, human populations in the deciduous forests to the south relied on riverine habitats. However, whereas residents of the poorly drained Saginaw Valley concentrated on a variety of fish in riverine and marsh habitats, southwestern Michigan groups focused on one anadromous species. As early as the Early Woodland period, lake sturgeons were intensively exploited during their spawning runs in the Grand River, and this was undoubtedly an essential factor in subsequent settlement systems.

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**MARTYNOVICH, N.**

**Poster:** *Birds from Bolshoy Yakor archaeological site (Vitim river, East Siberia)*

**Session:** General

**Abstract:** The archaeological open site Bolshoy Yakor (Large Anchor) is located on the lower reaches of the Vitim River, East Siberia. An area of more than 30 sq. m was excavated during the nine years of investigations. The sediment sequence consists of 19 layers dated from 12,400 to 10,100 B. P. Large Anchor is one of the few Pleistocene open site in Siberia where the remains of birds are numerous. 1416 bone remains of birds were found by washing sediments through a fine sieve are selected for

analysis, only from horizons VIII-IV. The following species are identified:

Layer IV: *Lagopus* sp. - 2\1 (NISP\MNI)

Layer V: *Anas* cf. *querquedula* - 1\1, *Lagopus* sp. 32\3, *Lagopus lagopus* 2\2, *Lagopus mutus* 1\1, aves indet (*Lagopus?*) - 9\?

Layer VI: *Lagopus* sp. - 1170\55, *Lagopus lagopus* 7\4, *Lagopus mutus* - 19\9, Passeriformes indet. - 1\1, aves indet (*Lagopus?*) - 158\?

Layer VII: *Lagopus* sp. - 1\1, Passeriformes indet. - 4\?

Layer VIII: *Lagopus* sp. - 7\2, aves indet (*Lagopus?*) - 2\?

Not only are all parts of the *Lagopus* skeleton found on site, but so are numerous small gastroliths. Proximal parts of the skeleton predominate, and the most common element is the scapula. No bones with cutmarks were found. The bird bones were poorly preserved, due to the influence of strong weather conditions. Only remains of adult individuals were found. The analyses of teeth of reindeer, elk and arctic fox show that occupation of site took place in a short time during late autumn-winter and late winter-spring. Apparently ptarmigans were caught with snares or were killed during the hunting of the main prey - reindeer. These birds reveal the natural environment in the area of the Large Anchor 10-12 thousand years back. On the one hand was the river valley with deciduous vegetation, on the other the neighbouring open low mountains with Alpine vegetation.

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**MARZIANO, C. & CHILARDI, S.**

*Contribution to the Knowledge of the Pleistocene Mammal-bearing Deposits of the Territory of Siracusa (Southeastern Sicily)*

**Session:** Taphonomy

**Abstract:** In the last decades Authors' researches have improved the number of Pleistocene mammal-bearing deposits in the territory of Siracusa (Southeastern Sicily) both in a quantitative and qualitative point of view. New hypotheses, alternatives to those expressed in the past, have consequently been formulated about the depositional processes and about all stages of their taphonomic history (re-working and erosion of sediments, differential preservation of the remains, alterations due to recent anthropic causes, etc). Thus, the aim of this work is to furnish an up-to-date list of this kind of site, examining in detail some examples of cave and open-air deposits on which the new hypotheses are based.

**Keywords:** Sicily, Siracusa, Pleistocene, dating, formation processes

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## MASHKOUR, M.

**Poster:** *Holocene Equids in the Qazvin Plain (Iran): A surprising diversity*

**Session:** Equids in Time and Space

**Abstract:** Archaeozoological analysis of 5000 Equid bones using different morphometric approaches reveals the existence of a great taxonomic diversity among Equids in the North of the Iranian Plateau from at least the VIth until the 1st millennia BC. These results obtained at a micro-regional scale engage a debate on the possibilities of an ecological explanation to such a zoological diversity. Identified wild species are 3 subspecies of hemionines (*Equus hemionus*), *Equus hydruntinus*, (never reported elsewhere in Iran) and finally the *Equus ferus* in the Neolithic levels. The latter is a particularly important find since the presence of a wild horse on the Iranian Plateau is a clue for a potential local domestication.

**Keywords:** Iran, Morphometrics, Taxonomy, Horse, Hydruntinus

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## MASHKOUR, M., BOCHERENS, H. & MOUSSA, I.

*Pastoral-Nomadisms in the Iranian Zagros traced back through isotopic study of intra-individual analysis of tooth enamel.*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** The question of the origin of the vertical transhumance in the Zagros region during Neolithic, Chalcolithic or even Bronze Age is examined through a program of intra-individual isotopic analysis of caprine teeth. For investigating the problem, a referential on modern specimens selected from a nomadic context had to be constructed. Thirty sheep and goats from the Bakhtiari nomad flocks have been collected during 2001, in the summer and winter quarters in the Bakhtiari region (Southwest Iran). Carbon and oxygen isotopic compositions of the enamel of permanent molars have been measured in a sequence along the tooth crown. With half of the specimens analysed so far, the obtained data already yield very valuable information related to the vertical transhumance. Some differences are also observed in the range of isotopic compositions measured on sheep and goat teeth from the same herd, and are probably linked to different dietary and behavioral habits. Tentative relationships between intra-individual range of isotopic compositions and individual behavior are proposed. The archaeological material of several selected prehistoric sites in

the Zagros is presently under investigation using a similar approach.

**Keywords:** Sheep Goat Carbon isotopes Oxygen isotopes Transhumance

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## MASON, M.A.

*What Do Dogs Mean? What Do Dogs Do?: Symbolism, Instrumentality, and Ritual in Afro-Cuban Religion*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Many African and African-based religions rely on animals and animal symbolism as key constituents of their rituals. In its many rituals, Afro-Cuban Santería, with its origins in Yoruba culture in West Africa, routinely employs a wide range of animals, both as sacrifices whose blood feeds the spirits and as ingredients in magical "works" designed to direct the spirits and control human behavior. Closely associated with deities of the forest, dogs appear frequently both in offerings and in "works". While exploring the meanings assigned to dogs can provide interesting information, the importance of dogs only becomes clear when their instrumentality comes to the fore. For practitioners of Santería, it is the dog's agency -- as a living animal or as spiritual presence maintained through remains -- that makes the difference.

**Keywords:** Dogs; Animal Symbolism; Cuba; Religion; Santería

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## MASSETI, M.

**Poster:** *Mediterranean islands as natural enclosures*

**Session:** General

**Abstract:** It seems likely that several of the tamed or semi-domesticated species of herbivores imported on Mediterranean islands since prehistorical times may have been kept and bred in a free-ranging state, enabling man to keep the number of animals under control through occasional hunting as required. This could explain why, for centuries, several islands were better known for their richness in certain zoological species, most useful as a source for meat than for their faunal repertoire in general. And this is still reflected even in the names of many of them. It could

have been one way of simplifying management problems, considering the islands as natural enclosures and allowing the animals to derive their food supply directly from the carrying capacity of the local environment. We cannot overestimate the importance of even small islands inhabited by free-ranging populations of herbivores, such as wild goats and hares, which represented living depositories of animal proteins available, from the prehistoric period on, along the marine routes of antiquity.

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## **MASSETI, M.**

### *Representation of deer in ancient Egyptian art*

**Session:** General

**Abstract:** Among the great many representations of wild mammals in ancient Egyptian art, only few figures can be confidently identified as deer. These representations range in date from the Predynastic period (Naqada III, 3,100-2,920 B.C.) down through the mid-Eighteenth Dynasty (about 1,400 B.C.). The Egyptian monuments then maintain a complete silence, during which the images of these ungulates vanish until the last quarter of the fourth century B.C., just prior to the Ptolemaic Period, when two animals are shown being brought as offerings in the grand tomb-chapel of Petosiris at Tuna al-Gebel. The identification and source of the deer species in ancient Egyptian art have been the subject of considerable discussion over the years. This is because deer are not generally regarded as belonging to the original zoogeography of Africa, with the sole controversial exception of the Barbary red deer, *Cervus elaphus barbarus* Bennett, 1833, which still occurs in the Khroumiria region, at the northern border between Algeria and Tunisia. Furthermore, most of the extant representation of deer in ancient Egyptian art display phenotypical characteristics which raise intriguing questions about the taxonomic identification of the portrayed species.

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## **MASSETI, M. & TRANTALIDOU, K.**

**Poster:** *Boars and goats in a Mesolithic fishing community: Youra (Northern Sporades, Greece), a case study*

**Session:** General

**Abstract:** The archaeological exploration of the Mesolithic levels of the Cave of Cyclops, on the island of Youra (Northern Sporades, Greece), yielded a number of interesting faunal remains, largely made up of shells and fish; this leads to the

assumption that the economy of the contemporary local human community was based predominantly upon the exploitation of marine resources. It seems, however, that the island fishermen also exploited mammals, as indicated by the discovery of numerous bones of *Sus scrofa* L., 1758, which clearly prove to be more numerous in the Lower Mesolithic levels than in those of the Upper Mesolithic, in which remains of *Capra aegagrus* Erxleben, 1777, were also found. The present paper deals with the role played by both these ungulates in the Mesolithic economy of Youra, with specific reference to the antiquity and significance of their presence on the island, as well as the fact that, in the case of the wild goat, this can be regarded as one of the most ancient introductions of the species by man in the Mediterranean area beyond its natural distribution, the species being completely extraneous to the fossiliferous horizons of the north-western Aegean region.

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## **MATEOS CACHORRO, A.**

*Meat and Fat? Intensive Exploitation Strategies in the Upper Palaeolithic, an Approach from Bone Fracturing Analysis*

**Session:** Animal Fats and Oils

**Abstract:** Fat is an essential economic resource in hunters-gatherers' palaeoeconomy, often underestimated in archaeological models. Its role in the diet, and many other uses (combustible, pigment cementing, waterproofing...) define the intensive exploitation of these animal resources in the Palaeolithic. The adaptive responses of Final Pleistocene human groups are analysed and also the basic features of subsistence strategies, distinguishing exploitation patterns by means of bone fracturing for the extraction of within-bone nutrients. Data regarding the biological cycles of some ungulate taxa and fat mobilization sequences in food stress periods are considered. An example of an Upper Palaeolithic assemblage is given in order to infer the meat procured and non-meat food strategies regarding the bone marrow or fat processing.

**Keywords:** Final Pleistocene. Cantabrian area. Subsistence strategies. Fracture Patterns. Bone grease.

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## **MATSUI, A., MINAGAWA, M., ISHIGURO, N. & HONGO, H.**

*Prehistoric Inter-island Trade and Introduction of Domestic Pigs to Ryukyu Islands in Southwestern Japan*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Ryukyu wild boar (*Sus scrofa riukiuanus*) inhabits only the Ryukyu Islands of southwestern Japan. Because of its much smaller size compared to the wild boar (*S.s.leucomystax*) found on the main islands of Japan, the Ryukyu wild boar was once considered as a feral population of the early East Asian domestic pig that had been brought to the islands in prehistoric times. It is now known to be a relict species of the Pleistocene *Sus* population in Asia. *Sus* remains that are larger in size than the modern Ryukyu wild boar have been found from prehistoric sites in the Ryukyu Islands. This suggests that domestic pigs might have been introduced to the Ryukyu Islands as early as 2000 bp. We have conducted chemical and molecular analyses to investigate the diet and the origin of *Sus* from selected sites on the Ryukyu Islands. The results were compared with those of modern and archaeological *Sus* samples from the main islands of Japan as well as from other parts of East Asia. Carbon and nitrogen isotope ratios indicate that the pigs from Early Kaizuka period (6,600-2,000 bp) sites were omnivorous or herbivorous, probably reflecting feeding treatment by humans. The results of mtDNA analysis of modern and archaeological *Sus* showed that haplotypes of the modern Ryukyu wild boar are different from both the domestic pigs and wild boars of East Asia. Ancient DNA haplotypes of *Sus* from some of these sites on the Ryukyu Islands are very closely related to those of East Asian domestic pig breeds. The results suggest that the domestic pigs were introduced to the Ryukyu Islands from the Eurasian Continent by the Late Kaizuka period (2000bp-10th century AD).

**Keywords:** Domestic pig, Ryuku, Japan, C and N isotopes, Mitochondrial DNA

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**MATTSSON, G.**

**Poster:** *Animal husbandry at Viking Age Åhus*

**Session:** General

**Abstract:** My dissertation project focuses on the animal economy of the Viking Age trading center and settlement at Åhus II in the province of Scania in southern Sweden. The site, located on the Helge River near the coast, dates to AD ca 750-875. Åhus was an important regional center and the artifacts and craft production debris reflect extensive trading contacts with the southern Baltic, Western Europe and the Orient. More than 1000 kg of animal bones were recovered during the archaeological excavations 1981-91. The study is based on a sample of 250 kilos of faunal remains from selected features across the site. The research objective is to reconstruct diet and animal husbandry practices to obtain a more complete picture of land use and stock raising in Viking Age Scania. Domestic animals are predominant with cattle being only slightly more common than sheep and pig. A variety of wild species of both birds and mammals are also present but comprise only a very small part of the material. The fish bones are analyzed in a separate study. Åhus shows similarities with both contemporary rural sites and early medieval towns. The species and age distribution of the domesticates suggests that Åhus was largely self-sufficient in regards to livestock rearing. The age distribution also shows patterns that are typical of early medieval towns, such as the emphasis on dairy and wool production, and the intensive pig rearing strategy. In general the species distribution reflects a varied cultural landscape with fields, meadows and pastures and some open woodland in the vicinity of Åhus.

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**MAYS, S.**

*Tuberculosis as a zoonotic disease in antiquity*

**Session:** Beyond 'interesting specimens':

palaeopathology and its contribution to the study of animal husbandry

**Abstract:** Two bacteria are primarily responsible for tuberculosis in mammals. *Mycobacterium tuberculosis* is almost exclusively a human pathogen; *Mycobacterium bovis* causes disease in diverse species, principally cattle, as well as in man. *M. bovis* is a zoonotic pathogen, that is it naturally transmissible between animals and humans. The balance between the two forms of tuberculosis in human populations may vary according to lifestyle factors. The prevalence of tuberculosis in domestic livestock may have an important bearing upon the tuberculosis burden in human groups, and the extent to which it affects livestock may vary according to husbandry practices. The question of the extent of *M. bovis* infection in earlier human and animal populations is therefore of great interest. This paper discusses both documentary and archaeological evidence pertaining to this problem.

**Keywords:** bovine tuberculosis; animal husbandry; ancient DNA

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## **McCORMICK, F.**

### *Dairying as a social institution*

**Session:** Milk, Milking and Dairying

**Abstract:** The origins of dairying are obscure but it is clear that dairying played differing roles in different early societies. In some, dairy produce seems to have been simply simply as another source of calories. A reading of the works of Columella and Varro indicates that this was generally the case in the Roman world. In others, dairying virtually became a social or religious institution. In India the cow became central to religious belief because it was believed that God created the cow specifically to provide milk for human beings, which was a continuation of the life sustaining role of the mother's milk for the infant. The cow is regarded as the mother of both gods and humans and in the process has become a sacred animal and dairying a religio-social practice. The earliest Hindu texts, the Rig Veda which arguably date to about 1000BC indicate the early date of this belief system. In contrast while documentary sources show dairying being practiced by the Sumerians before 3000 BC there is no evidence that cows or dairying became central to either their religious or economic institutions. In Ireland the earliest unequivocal evidence for dairying comprises bog butter that has been dated to the Early Iron age. The earliest documentary evidence, dating to the seventh and eight century AD, indicates a society where dairying held a central place in the livestock economy and wealth system of the period. The fact that this was a Christian society precluded a religious role for the cow. The milk cow was the most common unit of currency and they were used as payments for fines, rents, bride-prices and tribute. Because the value is in the live animal rather than its carcass products, i.e. meat and hides, it is understandable that dairying, as in the case of the modern Maasi, becomes the predominant livestock strategy. The fact that the cow was the unit of wealth has a profound effect on many aspects of society. Cattle rustling becomes endemic and this is reflected in the archaeological evidence in the emergence of the ringfort, a settlement form which seems to have developed as a response to this activity. The unique documentary sources, combined with faunal assemblages of the period, allows us to reconstruct the mechanics and values of a mature dairying economy.

**Keywords:** Cows, religion, secondary produce, wealth, Ireland

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## **MIKLIKOVA, Z.**

### *Medieval dogs from the southwest territory of Slovakia*

**Session:** General

**Abstract:** This poster presents new canid remains uncovered during the archaeological excavations conducted by the Archaeological Institute of the Slovak Academy of Sciences. Presented finds come from one urban site situated in Nitra - a market place, dated to the 9th century AD and the 16th-18th centuries AD, and further, from two rural settlement sites, in Nitra - part Mlynarce dated to the 12th-13th centuries AD, and in Baje, dated to the 8th-9th centuries AD and the 15th century AD (all of these sites are situated in the southwest of Slovakia). Partially or completely preserved skeletons of adult dogs (*Canis familiaris* L.) and in one case of adult wolf (*Canis lupus* L.) were found in settlement pits and houses. In total, 1790 canid skeletal elements were analysed. The variability in the body size of 19 individuals was observed. With the help of osteometrical data the shoulder height and proportions of the 13 complete skulls are discussed. According to Kolda's skull indices the analysed remains belong to a dolichocephalic group of dogs. Also, sex, age and health conditions of the studied individuals are described.

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## **MILLARD, A.**

### *A Bayesian approach to ageing sheep from toothwear*

**Session:** Ageing and Sexing

**Abstract:** Several schemes are available to estimate the age of sheep from tooth-wear, but none of them quantitatively takes account of the variability in wear observed in modern reference samples. This paper will present a new statistical approach to estimation of ages which takes account of these uncertainties and gives confidence ranges for the age of a given animal. Age profiles may also be calculated together with an expression of the uncertainty in them due to the uncertainties in ageing. The method could readily be extended to other species.

**Keywords:** age determination, Bayesian statistics, toothwear, age profiles

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## **MILLERSTROM, S.**

### *Facts and Fantasies: The Archaeology of the Marquesan Dog*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Dog burials and dog bones have been uncovered at several archaeological sites since the advent of modern archaeology in the Marquesas Islands (French Polynesia) in the mid 1950s. In addition, a large number of dog petroglyphs have been documented on the islands of Nuku Hiva, Hiva Oa, and Ua Huka. However, information on the Marquesan *Canis familiaris* is fragmented and the data has never been synthesized. It appears as if the dog held a privileged position among some of the island tribes. Spatial distributional information of dog petroglyphs shows that the images are both restricted to specific regions and valleys. In this essay I discuss archaeological evidence for the presence of dogs in the Marquesas and I relate this data to the spatial distribution of dog images.

**Keywords:** Marquesas Islands, Nuku Hiva, Polynesian *Canis familiaris*, dog petroglyphs, spatial distribution

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#### MILNER, N.

*Looking for human over-exploitation and environmental change in prehistoric oysters.*

**Session:** Archaeo-Malacology

**Abstract:** Shell middens occur worldwide and can span hundreds of years, and it is quite often noted at these sites that the shellfish become smaller through time. Change in species can also occur through a shell midden. Observations such as these have sometimes been used to suggest that the shellfish population has been over-harvested by humans. However, it has also been argued that it is very unlikely that humans can have such an impact on shellfish population sizes and demographics. Changes in species and changes in the size of shell have been noted for several of the Ertebølle kitchenmidden sites in Denmark. Using material from these sites, this paper will outline some of the methods used on the oyster, *Ostrea edulis* L., in order to investigate why such changes occur in the midden. The main approach has been to examine the incremental growth structure of the oyster, using modern controls, in order to age the shells and compare this with size. This reveals whether size decrease represents a reduction of average age and possibly over-exploitation, or a decline in growth rate caused by environmental factors. Such a study has also required some interpretation of the past environment from other proxy indicators. The results of these studies will be presented in this paper.

**Keywords:** Mesolithic, Neolithic, Molluscs, Middens, Environment

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#### MINNITI, C.

**Poster:** *Shells at the Bronze Age settlement of Coppa Nevigata (Apulia - Italy)*

**Session:** Archaeo-Malacology

**Abstract:** A large number of marine shells, over 50.000 pieces, were found at the prehistoric settlement of Coppa Nevigata, in the South-East of Italy (Apulia). The site lies on the border of an ancient lagoon at the distance of 7 km from the sea. Archaeological excavations brought to light town walls, several built-up areas, and cobbled pavements dating from the early to the late Bronze Age. Shells were recovered from all phases, but mostly from the middle Bronze Age levels. They provide information on various activities of the inhabitants of this settlement. The species that appear most frequently are *Murex trunculus*, *Mytilus galloprovincialis* and *Cerastoderma edule*. Other species are also represented but with only a few specimens. *Murex* shells are generally found in a fragmented state. During the Middle Bronze Age a heap of these shells was used to fill the area between the two towers of the surrounding wall. This area had been used as the entrance to the town. The large quantity and the condition of the *Murex* shells provide some indications of their use. They were likely to have been used for the extraction of purple. Large quantities of this mollusc, also probably used for the extraction of purple dye, were found in Aegean sites, too. The beginning of purple production is dated between the end of the Middle Minoan and the beginning of Late Minoan periods. Excavation data indicate the existence of trading activities between Coppa Nevigata and the Aegean area. *Mytilus* and *Cerastoderma* shells were not found in the same areas and layers that produced the *Murex* specimens. They are likely to represent a form of a food reserve. Shells also provide information about the natural environment and the strategies of procurement of living molluscs. *Mytilus* lives on rocky sea environments, while *Cerastoderma* could have been collected in sandy marine areas or in the lagoon. Finally, a few worked shells of different species were also found at Coppa Nevigata. These were all perforated shells. It is possible that these holes were created by the action of natural agents or lithophages, but many shells had certainly been perforated and shaped by people.

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#### MINNITI, C. & PEYRONEL, L.

**Poster:** *Worked astragali from Tell Mardikh-Ebla and Syria-Palestine during the Bronze and Iron Ages.*

**Session:** General

**Abstract:** Worked and unworked astragali or knuckle-bones were found in several contexts at Tell Mardikh-Ebla (Syria) from the Early Bronze Age through the Iron Ages. They were usually ovicapid bones, sometimes cut lengthwise with one side smoothed. Groups of astragali were found also in numerous Syro-Palestinian settlements, pointing out at some ritual or funerary significance, since they were stored in sacred buildings

as offerings or buried as funerary assemblage. One of the most important discovery come from Megiddo, where a cache of ca. 700 astragali was found inside a jar in a room dating from the beginning of the Iron Age. The Eblaic evidence seems to confirm the ritual hypothesis and the symbolic nature of the astragalus: groups of astragali come from Middle Bronze burials, and a child-burial was accompanied by ca. 200 knuckle-bones together with a faience vessel. The storing of large amounts of these bones in vessels or caches suggests that prior to being eventually offered astragali were 'property' of private citizens, and therefore they could also be considered as objects reflecting wealth of the owners. At the same time the scattered presence at Ebla of more limited groups of knuckle-bones from private houses and fortresses locate on the MB rampart suggests also an utilitarian function as gaming-pieces, which is supported from ethnographic parallels and from their use during the Roman times.

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#### MONCHOT, H.

*Statistical nonparametric methods for the study of fossil populations*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The precise knowledge of the number and nature of the species belonging to a fossil assemblage as well as the structure of each species (age, sex...) is of great importance in zooarchaeology, especially for the beginning of the domestication of ungulates. Mixture Analysis based on the method of Maximum Likelihood is a modern statistical technique that concerns the problem of samples consisting of several components, the composition of which is not known. Nonparametric Bootstrap and Jackknife techniques are used to calculate a confidence interval for each estimated parameter (prior probability, mean, standard deviation) of each group. The Bootstrap method is also used to mathematically evaluate how many groups are present in a sample. Experimental density smoothing using the Kernel method appears to be a better solution than the use of histograms for the estimation of a distribution. Some preliminary results concerning sex ratios and mortality profile assessments using bones and tooth metric data of small (*Ovis antiqua*) and large (*Bos primigenius*) bovines from European Pleistocene sites are presented and discussed.

**Keywords:** Morphometry, Sex ratio, Mortality profiles, Mixture analysis, Histogram smoothing

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#### MONKS, G.G.

*An Oil Utility Index for Whalebones*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Nuu-chah-nulth (Nootkan) whaling has attracted considerable attention because of the unusual nature of this aboriginal adaptation. Other authors have derived meat and architectural utility indices for whales in the arctic, but these indices have little explanatory value for understanding the types and frequencies of whalebones found in archaeological sites on the Northwest Coast of North America. This paper presents an oil utility index for whalebones and compares the index values to the estimated oil productivity of whalebones collected from two sites on the west coast of Vancouver Island and from the Ozette site in neighbouring Washington State. Alternative explanations of archaeological whalebone frequencies are also considered. The analysis of these whalebone assemblages in terms of their oil utility indicates that those bones containing relatively large amounts of oil are the most likely to be transported onto the site. The antiquity and social correlates of this practice are discussed.

**Keywords:** Whalebones, oil utility index, Nuu-chah-nulth (Nootka), Northwest Coast

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#### MOORE, E.E.

**Poster:** *Dogs of Virginia: biting the hand that feeds you?*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Dogs have been present in North America for thousands of years. It is clear from the zooarchaeological evidence that Native Americans in what is now the Commonwealth of Virginia in the Middle Atlantic region of North America (USA) used or kept dogs for a number of purposes, for much of that time span. The varied uses of dogs is evidenced by the presence of their remains in a variety of archaeological contexts. Dog remains have been frequently recovered from secondary contexts such as trash pits and middens, ranging from skeletal fragments to relatively complete individuals. Individual and multiple dog burials have also been found, indicating that dogs played many roles, in addition to those of dietary contribution or beasts of burden. One example in particular, the Hatch site, presents an intriguing interpretive challenge; several of the dog burials at the site contained human arms. This unique set of burials indicates that these dogs probably served social or symbolic purposes as well as practical ones. This poster surveys dog remains from Virginia archaeological sites for the entire span of its pre-European habitation. In addition, historic accounts written by European

explorers in the New World will be examined for references to the presence and use of dogs.

**Keywords:** dog burials, Hatch site, Middle Atlantic region, pre-European North America

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## MOORE, K.M.

*Zooarchaeological Measures for Fat Selection at Panaulauca, Highland Peru*

**Session:** Animal Fats and Oils

**Abstract:** Panaulauca is a deeply stratified rockshelter site in Junin, Peru. Prehistoric occupations span 7600 B.C.E. to ca. A.D. 1400. The elevation (4100 m) and ecological setting of the site make it likely that local produced plant resources would have been scarce while mammals (deer, wild camelids, and later, domesticated camelids) grazing in this high grassland would have been relatively abundant. Even so, the scarcity of plant food and the lean meat from these animals suggests that fat would have been an essential, possibly limiting food. This ecological reconstruction is supported by at least three data sets: the abundance of taxa of the animal remains, the paleoethnobotanical remains, and carbon and nitrogen stable isotope determinations on human and animal bone collagen. Two processes have emerged in zooarchaeology in the past decades to explain the distribution of body parts: the selection of body parts according to economic utility, and the differential destruction of body parts by attrition according to density of particular elements. Both processes affect the same elements, though the order and severity of selection may vary with cultural and ecological setting and archaeological context. In this study of the Panaulauca bone assemblage, I seek to isolate the effects of differential destruction by non-human agents and isolate selection and fragmentation of bone that was oriented toward dietary goals. Selection, breakage, and fragmentation are studied for bones and body parts, combining identifiable and unidentifiable fragments. The representation of body parts reflects meat utility to some extent, but the fragmentation of elements seems to be most affected by the liberation of within-bone nutrients. This emphasis upon fat recovery relates to the long-term occupation of the region and the development of crop agriculture in a difficult environment.

**Keywords:** Andes, Camelids, Body-part representation, Diet, Fat

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## MORALES, A.

## Discussant

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

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## MORENO-GARCIA, M.

*Hunting practises and consumption patterns in Moslem mountain communities of the Rif (Morocco) – some ethno-zoological notes*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** We describe our ethnographic studies among Moslem pastoral and farming communities in the western Rif (Morocco) - in particular the role played by hunting. In recent times, before this activity was made illegal, wild animals provided an important supplement to the local economy. The techniques used to hunt and exploit species such as wild boar, jackal and hedgehog are discussed. Results show that these self-sufficient communities did not waste any of the meat resources available, including those forbidden by their religious beliefs. We suggest an ethno-zoological model to help interpret remains of these wild species in zoo-archaeological assemblages.

**Keywords:** hunting, meat consumption, Moslem Morocco, ethno-zoology

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## MUIR, R. & DRIVER, J.

*Identifying ritual use of animals in the northern American Southwest*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Ethnographic data suggest that numerous species of vertebrates were incorporated into the ritual and ceremonial life of the Puebloan peoples of the American Southwest. We use spatial and contextual analysis of faunal remains on prehistoric sites to examine this long-standing tradition. Non-random distribution of fauna, coupled with strong associations of certain species with certain contexts suggest that deposition of some species was influenced strongly by ideological considerations.

**Keywords:** Pueblo, American Southwest, spatial analysis, contextual analysis, ideology



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**MUKHERJEE, A.J., EVERSHERD, R.P. & GIBSON, A.M.**

*Compound-Specific Stable Isotope Analysis in the Classification of Animal Fats in Neolithic Grooved Ware Pottery*

**Session:** Animal Fats and Oils

**Abstract:** The Late Neolithic Grooved Ware tradition is thought to have originated in Orkney about 3000BC and spread southwards, appearing well established in southern Britain by about 2500BC. Large assemblages of Grooved Ware have been associated with ritual sites with smaller assemblages also appearing at domestic sites. An association has been found to exist between Grooved Ware and pig remains, this is in contrast with non-Grooved Ware pottery traditions, which are associated with sites yielding a predominance of ruminant animal bones. A recent study in our laboratory has emphasised this bias, compound-specific stable isotope and triacylglycerol analyses of animal fat residues in pottery excavated from the Welsh borderland showed that Grooved Ware vessels contained porcine adipose fat while Peterborough Ware vessels contained ruminant adipose fats. Reasons for the differences in patterns of exploitation of these major domesticates are not understood. They could indicate a period of economic change perhaps involving improved animal husbandry practices, reflect the dictation of religious or cultural beliefs or perhaps infer taboos associated with animals related to disease and human health. This research involves the systematic investigation of organic residues found in Grooved Ware vessels together with examples from the earlier Neolithic period (Peterborough Ware) and the Early Bronze Age (Beaker Ware). High temperature-gas chromatography (HT-GC), gas chromatography-mass spectrometry (GC-MS) and gas chromatography-combustion-isotope ratio mass spectrometry (GC-C-IRMS) are used to establish whether this bias towards pigs is a true feature of the Grooved Ware pottery tradition. Pottery assemblages used in this study include Yarnton Floodplain, Durrington Walls and Skara Brae. In addition to the study of archaeological materials, the tissues of modern animals (ruminants and non-ruminants) and their diets are being examined to determine the fundamental biochemical and/or physiological/metabolic basis for the isotopic differences between the fatty acids of pigs and ruminant animals.

**Keywords:** Grooved Ware, Neolithic Britain, pigs, ruminants, stable isotopes

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**MÜLLER, W.**

*Domestication of the wolf – the inevitable first?*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** It will be elaborated on the hypothesis that the wolf was not by chance the first species to be domesticated, but rather that it was necessary to pave the way for the domestication of the other species. The first question that arises is, whether the first steps of the wolf domestication were undertaken consciously or unconsciously. It will be made plausible that a conscious proceeding is highly unlikely, given the complexity of the process. The second question that follows is, what traits will have been selected for (unconsciously) in the beginning. It will be shown that behavioural traits, namely flight and socialising behaviour, have preceded the selection for size and morphological traits. However, it will be proposed that only when selection for morphological traits has set in, a perception and thus consciousness for the heritability of traits and therefore for domestication as a process can have arisen. For discussing the initial question, if the wolf was the inevitable first domesticate, the developmental sequence of several factors, like suckling time, socialising and flight behaviour, as well as the social structure of a wolf pack will be discussed. It will be argued that these factors predestined the wolf above all other livestock to be the first domesticate, and that the unconscious first steps of wolf domestication might even be considered prerequisite steps for the following breeding of other animals and even plants.

**Keywords:** domestication, *Canis lupus*, behaviour, Magdalénien, Central Europe

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**MULVILLE, J.**

*A Whale Of A Problem? Zooarchaeology and Modern Whaling*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Since 1982 there has been a moratorium on commercial whaling. However the International Whaling Commission (IWC) recognises subsistence whaling, the catching of whales by indigenous people for local consumption, as qualitatively different from commercial whaling and does not prohibit it. Aboriginal subsistence whaling is presently permitted from Denmark, the Russian federation, St Vincent and the Grenadines, Canada and the USA. There has been a recent resurgence in claims to subsistence and commercial whaling rights, for example the Makah in Washington State recommenced the hunting of grey whales in 1998. Two countries within the IWC, Japan and Norway, seek to recommence commercial whaling and are actively pursuing this right. In the negotiations for whaling rights, subsistence rights and commercial rights, many different strands of evidence have been exploited, and these include archaeological, historical and cultural data. In Alaska the 2900 B.P. Old Whaling Culture site at Cape Krusenstern is often mentioned to indicate the antiquity of aboriginal whaling and sealing in Alaska. Similarly in Greenland, reference is frequently made to a 4500 year old site in Disko Bay where 60% of bones in middens were from marine mammals. The "needs statement" issued by the Makah of Washington State, included reference to the intensive archaeological work at the Ozette site. In Japan the existence of extensive documentary evidence going back several centuries provides the basis for a cultural claim to whaling. Whilst the Norwegians have used rock art to argue for the antiquity of their whaling. This paper considers the use of zooarchaeological evidence within this emotive area and demonstrates how our investigation of the past human/animal relationship can become a powerful force in the decision making process of the present.

**Keywords:** Whaling, subsistence, commercial, rights, International Whaling Commission

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#### MUNRO, N.D.

*Bone Marrow, Grease Extraction, and Intensive Resource Use During the Natufian Period (ca. 12,800 - 10,200 B.P.) at Hayonim Cave, Israel.*

**Session:** Animal Fats and Oils

**Abstract:** As the period immediately preceding the transition to agriculture, the Natufian period in the Levant (ca. 12,800 - 10,200 B.P.) provides an ideal forum to investigate the roots of revolutionary subsistence change. Resource stress and population pressure are recurrent theme in explanations of agricultural origins, but have proven difficult to establish in the archaeological record. This paper uses the intensity of gazelle carcass processing as a proxy measure to detect imbalances between human population size and resource availability in the Natufian period. Intensive processing is defined as the thorough extraction of nutrients including meat, marrow, and grease from prey carcasses, and can be detected in patterns of bone breakage, fragmentation and survivorship. Significant correlations between

marrow content and the intensity of long bone fragmentation in the Natufian deposits from Hayonim Cave indicate that marrow was habitually harvested from gazelle carcasses. Furthermore, the survivability and fragmentation of cancellous regions of gazelle axial and appendicular skeletons indicate preferential destruction of grease-rich areas. Overall, the Natufians made thorough use of all edible components of gazelle skeletons, stopping short only at breaching small compact elements with tiny marrow cavities. The intensity of use, especially in comparison to pre-Epipaleolithic periods suggests that the Natufians pushed their most important animal resource close to their productive limits, likely with the aid of groundstone technology. Finally, the methods presented here also contribute to a growing body of literature aimed at distinguishing marrow and grease processing from other post-depositional processes in the archaeological record.

**Keywords:** Bone butchery, Southwest Asia, transition to agriculture, gazelle carcass processing, intensification

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#### MÜNDEL, S. & CONARD, N.

*Change and Continuity in the Paleolithic Subsistence of the Ach Valley of Southwestern Germany*

**Session:** Neanderthal ecology

**Abstract:** The key Middle Paleolithic sites in the Ach Valley are Sirgenstein, Große Grotte, Geißenklösterle, and Kogelstein. These sites provide the main sources of information about Neanderthal adaptations in this archaeologically important tributary of the Danube. The first three sites are caves positioned high above the valley floor, while the last site is located in the valley bottom near Schmiechener Lake. All of the sites have produced diverse faunal assemblages with a complex mixture of archaeological and paleontological fauna. Age profiles of the bear populations from Sirgenstein, Große Grotte and Geißenklösterle indicate that the sites were often used as dens. Numerous remains of very young hyenas at Kogelstein indicate that it was also used as a den. Taxonomic proportions vary both between and within sites, but horse, red deer, ibex, chamois and fox were exploited regularly during the Middle Paleolithic. The only available evidence for seasonality comes from fetal bones of horse from Sirgenstein and suggest a winter occupation. During the Middle Paleolithic, bone rarely served as a source of fuel, and the density of archaeological finds is seldom high. With the beginning of the Upper Paleolithic, the faunal assemblages from Geißenklösterle, Sirgenstein, Hohle Fels and Brillenhöhle show indications of both continuity and change relative to the Middle Paleolithic. Sites continue to be used regularly by cave bears, but their relative numbers decline, and there is convincing evidence for bear hunting in the Gravettian. Smaller animals including hare and fish become more numerous. Mammoth becomes common. Horse and reindeer increase in importance. Several sites provide evidence for valley occupations during winter and spring, and

bone is systematically used for fuel. Finally, worked bone and bone tools, rare in the Middle Paleolithic levels, are at times numerous in the Upper Paleolithic deposits. Thus, the archaeological record and cultural adaptations documented in the Ach Valley during the Upper Pleistocene are characterized by both stability and change.

**Keywords:** Neanderthal, Middle Palaeolithic, Danube, Germany

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## MURPHY, E.

### *Animal Palaeopathology in Ireland: An Overview*

**Session:** Beyond 'interesting specimens': palaeopathology and its contribution to the study of animal husbandry

**Abstract:** When complete animal skeletons are available for palaeopathological examination it is possible to examine the distribution of lesions and gain a clear understanding of the manner in which disease processes affected a particular animal in the past. Animal palaeopathology, however, is an aspect of archaeozoology that has generally been neglected in Ireland. This is largely due to the fact that animal bone assemblages comprise the butchered and disarticulated remains of food refuse and it is generally impossible to analyse a pathological bone within the context of the individual skeleton. Nevertheless, the analysis of palaeopathological lesions from disarticulated assemblages of animal bone can still provide important information at a population level on a variety of archaeozoological issues, and it is possible to gain an impression of aspects of past animal health, livestock practices, and human and animal interaction. The objective of the paper is to provide an overview of the palaeopathological findings derived from a substantial corpus of Irish animal bone assemblages. In addition, an attempt will be made to interpret a number of trends that are apparent in the distribution of palaeopathological lesions among the different species. The assemblages have largely derived from Medieval and Post-Medieval urban excavations, although a number of interesting lesions, including a case of cattle polydactyly, have also been identified among prehistoric animal bone assemblages.

**Keywords:** Ireland, animal palaeopathology, Medieval, prehistoric

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## NAKAJIMA, T.

### *Freshwater Fisheries during the Jomon and Yayoi Periods in Japan*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Analyses of the pharyngeal tooth remains of cyprinid fish assemblages from prehistoric Japan have provided important archaeological and paleontological data. Pharyngeal teeth of extinct or locally extinct fishes have been retrieved mainly from western Japan (southern Honshu and Kyusyu) area between Jomon and Yayoi periods. These findings imply that several cyprinid fishes became extinct during or after the Jomon period as the result of the artificial impact of human activities. In Jomon period, pharyngeals of extinct fishes have been found in the Awazu shell midden and the Akanoi Bay ruins on the lake bottom of Lake Biwa and in the Torihama ruins on the shore of Lake Mikata. The analysis has shown that the freshwater fishery during the spawning season played an important role in subsistence in the Jomon period; furthermore, many of the fish caught during the spawning season were processed and preserved for food stock assuring year-round habitability. Pharyngeal tooth remains also have found in some Yayoi sites. The Shimonogo ruins in Shiga Prefecture comprise ruins of a Yayoi village surrounded by several ditches. Although the fish remains show wide-range diversity, the deep-body crucian carp or "Gengorobuna," *Carassius cuvieri* was dominant. Irrigated paddy field system obviously played a primary role of economy at that time, and the irrigation canals and paddy fields served to induce of fish to come up from the lake to the village. Paddy fields were thus not only sites for rice farming, but also for crucian carp fishing. Most cyprinid fish species in Japan inhabit irrigation systems of paddy fields. Some of them utilize the paddy fields themselves as spawning and nursery sites and are therefore called "paddy field fish." It seems that some relict fish lost their ecological niche as the paddy field fish expanded their range.

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## NARDINI, A. & SALVADORI, F.

### *A GIS platform dedicated to the production of models of distribution of archaeological remains: the experience developed in the case of the faunal remains*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** The paper considers a computerised tool for processing faunal remains with the use of a GIS (Geographic Information System) solution. Archaeological data processing can be done on different levels: it can concern both the production of thematic maps or the elaboration of interpretative and predictive models, using statistical and mathematical tools.

The difference between an excavation and an animal bones analysis GIS platform is based on differences in data processing methods. In particular the detail level shifts from stratigraphical contexts to the set of bone fragments pertaining to the same context (or structure, or period, etc.); at the same time the underlying database (strictly dialoguing with the GIS platform) becomes our animal bones DBMS. Data frequency (and eventually other statistical analysis) are fulfilled on the DBMS and then imported within the GIS platforms as points related to the zooarchaeological sample; using a GIS technique called geocoding, coordinates of the points are generically positioned inside the stratigraphical context they belong to. Our aim is to display the bones deposit, by using stratigraphical and zooarchaeological keywords in order to understand how anthropological, animal and natural factors transformed the original animal population into a fossilized sample. Experimenting of GIS technology on a large open area excavation like Poggio Imperiale (more than 1.5 hectares excavated, with a bone sample of 5763 fragments), has allowed us to produce important information used in elaborating diachronical models of social and economical structures; it is also possible to predict the archaeozoological potential of non-excavated areas, through a combination of statistical and spatial analysis.

**Keywords:** Archaeozoology, Geographic Information System, Faunal remains, Medieval archaeology, Computer applications in archaeology, Quantitative methods.

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#### **NICHOLS, C. & HOELZEL, A.R.**

**Poster:** *Genotyping bottlenose dolphin samples from an Anglo-Saxon site at Flixborough.*

**Session:** General

**Abstract:** Bottlenose dolphins (*Tursiops truncatus*) in waters surrounding Britain are the most northerly populations of this species and show a discontinuous modern distribution in UK waters. The excavation of an Anglo-Saxon site at Flixborough, near the Humber Estuary in eastern England, has yielded the largest archaeological sample of bottlenose dolphin remains yet found in Britain; however, the estuary does not currently support a bottlenose dolphin population. This offers the opportunity to add a temporal component to our analyses of the spatial pattern of genetic structure of UK bottlenose dolphin populations. We are comparing mtDNA control region sequences from the remains at Flixborough with samples collected elsewhere in the UK and around the world. The reference database includes approximately 150 sequences from 10 geographic regions. So far two sequences have been successfully obtained from the ancient samples, and work is

commencing to complete extractions from samples of each individual dolphin from the site. Possible outcomes include the identification of a relationship to a current population suggesting a redistribution, differentiation suggesting local extinction, or a mixture of genotypes from divergent populations. The latter would suggest they were hunted in several areas and moved to this site, but this seems least likely.

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#### **NICHOLSON, R.**

*Oil from Troubled Waters: Fish and Sea Mammal Oil as a Valuable but Archaeologically Overlooked Resource.*

**Session:** Animal Fats and Oils

**Abstract:** While we are all familiar with the numerous uses of and products derived from cattle and other domesticates, marine animals can also provide a range of secondary products. Oil derived from marine mammals and fish has been, and is, valued for purposes as diverse as nutritional supplement, as an ingredient in myriad foodstuffs and cosmetics, as animal feed and, particularly in the past, as a valuable fuel. This presentation will discuss the value of marine mammal and fish liver oil as a versatile and storable product of considerable importance to island peoples. Historically, oil has been extracted from whales, seals and other sea mammals, a range of oily and white fish and even otters. Focussing on ethnographic and archaeological examples drawn mainly from the Northern Isles of Scotland, the problems and potentials of identifying the use and importance of fish and sea mammal oil will be considered. An archaeological example will be used from the Shetland Isles, UK. Excavation at the site of Old Scatness Broch has demonstrated the importance of juvenile saithe *Pollachius virens* as a foodstuff during the Iron Age. In the 18th and 19th centuries these sillocks and pillocks were the source of intensive local fishing, and when dried provided the mainstay of the winter diet for the crofters. In addition, the livers were boiled to provide oil for lamps, and quantities of both fish and whale oil were exported. The significance of the archaeological fish remains will be discussed in the light of the potential value of fish oil as a storable resource.

**Keywords:** Fish, Marine Mammal, Oil, Shetland Isles, *Pollachius virens*.

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#### **NIVEN, L.**

**Poster:** *The Woolly Rhinoceros (Coelodonta antiquitatis) remains from the Palaeolithic cave site of Vogelherd, Germany*

**Session:** General

**Abstract:** The cave site of Vogelherd (Baden-Württemberg, Germany) was excavated in 1931 and produced exceptionally rich Middle and Upper Palaeolithic deposits. The Upper Palaeolithic (Aurignacian) horizons contained the densest concentrations of faunal remains in addition to stone and organic artefacts, ivory artworks, and fossils of early modern Homo sapiens. The archaeofaunas from both the Middle and Upper Palaeolithic deposits represent a variety of cold-stage Pleistocene taxa with a substantial assemblage of woolly rhinoceros (*Coelodonta antiquitatis*). A minimum of 10 individual rhinoceroses come from the Middle Palaeolithic deposit but taphonomic signatures suggest their accumulation was the result of both large carnivores and hominids. There is more suggestion of human involvement in the Aurignacian rhinoceros assemblage (12 individuals). Age profiles from both assemblages show a predominance of infantile and juvenile animals with few adults; methods for aging woolly rhinoceros teeth and the implications of the age profiles are discussed. Woolly rhinoceros is frequently recovered in Palaeolithic sites in Eurasia and these assemblages provide an interesting background in which to examine the rhinoceros remains from Vogelherd.

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**NOBAYASHI, A.**

*An Ethnoarchaeological Study of Chase Hunting with Gundogs by Taiwans Aboriginal Peoples*

**Session:** General

**Abstract:** Hunting was the most important subsistence activity after agriculture for Taiwans aboriginal peoples. They have traditionally hunted wild boars and other mammals. They do their hunting under legal control at the present, and continue to develop and adapt their hunting methods. Chase hunting with gun dogs is one of their traditional hunting methods. The author carried out ethnoarchaeological research on both chase hunting and snare hunting. The mandibles of wild boars, which were captured by chase hunting and snare hunting, were analyzed. The age structures of both populations were compared, and found to differ. In chase hunting, relatively more adult individuals were captured than in snare hunting. This result may be an “hunting signature with gundogs”, indicating that people were using gundogs in hunting. Wild boars are fierce mammals and they do not have a natural enemy in Taiwan. It is not easy for dogs or other carnivores in Taiwan to capture a wild boar, especially an adult individual. It is also difficult for people to hunt wild boars without gundogs when chase hunting. An adult aboriginal male must capture a wild boar without gundogs to obtain social approval in some Taiwan aboriginal societies. Despite their cultural background, these hunters may choose chase hunting with gundogs rather than snare hunting to capture adult animals.

**Keywords:** Gundogs; Hunting; Ethnoarchaeology; Taiwans Aboriginal Peoples

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**NOE-NYGAARD, N. & RICHTER, J.**

*Differentiation and specialization in the late Ertebølle-culture, heralding introduction of agriculture? A Late Mesolithic hunting station at Agernæs, Fyn, Denmark*

**Session:** General

**Abstract:** The Late Ertebølle hunting site from Agernæs, Fyn, Denmark, 4200 cal yrs BC (51-5200 14C yr. BP), has yielded a total of 32 animal species. The inhabitants of the site seem to have been highly focused on hunting for fur animals. Pine marten has been a main target with 33 individuals further a specialized hunting strategy has been applied. Bone fragments and stable carbon isotope data from 10 species indicate that the main animal food source was terrestrial, while the isotope data from man and dog indicate a dominant marine diet. It is thus unlikely that Agernæs was the central base camp. The Agernæs habitation rather represents a specialized hunting site, indicating that economic differentiation already was in progress. The high species diversity include eight species of fur animals comprising pine marten, polecat, wolf, fox, domestic dog, lynx, wild cat and otter. Neonatal red deer and roe deer were apparently only hunted for their skins. Animals hunted for consumption comprise aurochs, wild boar, adult red deer and roe deer. The season of activity is determined by the presence of newborn red deer, roe deer, piglets from wild boar. The time of skinning of the pine marten add to delimit the season. The biometrical data from red deer, roe deer and wild boar indicate free migration between the island of Fyn and the peninsula of Jylland. The main habitation period of the site appears to fall between the Late Atlantic and the Subboreal Littorina transgression by comparison with data from the Littorina-transgressions at Vedbæk, Storebælt, Trundholm Mose and Troldestuen. What were the triggers for the Mesolithic/Neolithic transition? Termination of the Late Atlantic climatic optimum (8000-5000 14C BP)? Radical changes of the forested landscape during the elm decline? Diversification of the late Mesolithic economic activities? The last may have created the foundation for introduction of domestic animals only a few hundred years later than the habitation of the Agernæs site.

**Keywords:** Mesolithic, Ertebølle, Denmark, C and N isotopes, Neolithisation

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**NOGUEIRA DE QUEIROZ, A.**

**Poster:** *Gruta do Gavião and Gruta do Pequiá: an archaeozoological and taphonomical approach to Amazonian prehistorical sites in Brazil*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** Bad conservation of organic material at the Amazonian region is mostly due to higher level of humidity and soil acidity. Biological agents as predators (carnivores, and birds of prey), bioturbation, diagenesis and weathering are the major non-human agents affecting the density of animal remains from the caves of Gruta do Gavião (dated between 8140±130 and 2900±90 BP), and Gruta do Pequiá (dated between 9000±50 and 8119±50 BP) located at Pará state, Brazil Northern. Besides, the fauna recovered from these caves often shows remarkable evidences for both human and non-human activities of accumulation and/or modification. Concentrations of fires (charcoal) in these caves, with archaeological artifacts and burnt marks on the bone and osteoderma samples indicate human activities for preparing food. Rare bone tools are another indications of anthropogenic action in the modification and accumulation of osteological assemblage. Taphonomical, qualitative and quantitative observations shows age groups and animal size seems to be linked to the human preference of some species for feeding (*Agouti*, *Dasyprocta*, *Mazama*, and *Tayassuidae*). Many burnt postcranial parts of these groups were recovered. Small species like Sigmodontinae rodents (*Akodon*, *Oryzomys*, *Oxymycterus*, and *Rhipidomys*), and Didelphidae, as *Monodelphis* were mainly characterized by cranial elements. During the study of these caves, we verified a great quantity of Murinae bones (*Rattus* and *Mus*) in ancient chronologies (between 9000 and 2000 BP). If it is confirmed, it suggests these species were introduced before the colonization period of the country (XVIth Century).

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**O'CONNOR, T.**

*Demography by numbers: age, sex, and zooarchaeological practice*

**Session:** Ageing and Sexing

**Abstract:** An overview of technical developments in the attribution of age and sex to ancient bones shows that considerable advances have been made in some techniques, such as in the resolution of age at death from dental evidence, and much less in others, notably the analysis of epiphysal fusion. The quality of modern analogue data remains a problem, and one that is not helped by the husbandry practices current throughout much of the world. Limits to the resolution of the zooarchaeological data are set in part by the limitations of our techniques, and in part by the underlying biological processes. Understanding those processes, and therefore the limits beyond which technical developments cannot take us, is a priority.

Attribution to sex remains an urgent issue in all analyses of hunting and husbandry, but one that has made only limited advances in recent years. The use of multivariate shape analysis offers the prospect of improving our simple interpretations of uni- or bivariate metrical analyses. Ancient DNA analysis offers a new approach to the attribution of sex, but is likely only to be applicable to limited numbers of specimens in particular circumstances. Perhaps the most pressing area for further research and development lies in the inference of information from our demographic data, both in understanding the taphonomy of the assemblages and hence the population that they represent, and in developing mortality models as an heuristic device to aid data interpretation.

**Keywords:** mortality, husbandry, sex, data interpretation

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**O'DAY, S.J.**

*Past and Present Perspectives on Secular Ritual; Food and the Fisherwomen of the Lau Islands, Fiji*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Secular rituals, everyday routines of social life, have often been a secondary consideration for anthropologists who have typically focused on "religious rituals." Nevertheless, secular ritual practices are formally patterned and of potential symbolic importance. Indeed, ethnographic and archaeological studies in Fiji and Polynesia illustrate that religion, economics, and politics are tightly associated. These institutions hinge on social organizational principles of hierarchy, which are reproduced in practice, or through human behaviors. In Fiji and Polynesia secular and religious rituals can be heuristically divided, but are related within this social system. In this paper I discuss recent archaeological and ethnographic work, focusing on secular rituals that involve subsistence and food, in the Lau Islands of Fiji. Topics including marine resource exploitation, food distribution, variation in consumption patterns between women and men, and refuse disposal are addressed. My preliminary research indicates that animal resource exploitation patterns are, just as they were in the past, affected by accessibility that is both environmental and cultural. In this case, cultural accessibility refers to patterns of food distribution and consumption that are regulated by rituals that reproduce a system of hierarchy.

**Keywords:** Fiji, hierarchy, secular ritual, fisherwomen, marine resources

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## O'REGAN, H.

### *The Interface between Conservation Biology and Palaeontology*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** In broad terms, conservation biology seeks to sustain species which are vulnerable to extinction, whilst palaeontology is the study of past organisms. This talk will highlight two areas in which methods already in use in one field may be used to inform the research carried out in the other. The first example is an investigation into the effects of captivity on the osteology of wild animals, specifically the big cats. The behavioural effects of captivity have been documented but much less is known about the osteological effects and there may be subtle morphological differences between wild and captive animals of the same species. Morphometrics is a tool which is frequently used in palaeontology and can easily be applied to modern specimens. This case study will illustrate this using a morphometric analysis of the skulls of big cats which has revealed significant differences between wild and captive individuals. The second example shows the potential of conservation genetics and population biology to answer questions about the effects of European Pleistocene glaciations on large mammals. Techniques and theories such as effective population sizes and population viability analysis are used to estimate the chances of extinction in vulnerable modern populations. These theories can also be applied to fossil mammals, in particular those which still have extant populations. This then provides a useful tool for understanding the potential genetic effects of fragmented populations in glacial refugia, although it is necessary to estimate some calculations. In conclusions there is an enormous amount of potential for interdisciplinary research in areas such as these, but we need to look outside our immediate fields of expertise.

**Keywords:** captivity, morphometrics, population biology, big cats, Quaternary

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## OLJDAM, E.

### *Fishermen, Turtles and a Deltaic Coastline: an Attempt at Correlating Babylonian Terminology and Archaeo-zoological Assemblages*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** During the beginning of the second millennium BC a diverse set of data sheds some light upon the exploitation of marine resources in the northern extremity of the Arabian Gulf. These waters were exploited by fishermen of three separate

political entities: Babylonia, Elam, and Dilmun. The crux of the presentation is the \*tension\* between the exploitation of large quantities of turtles by Babylonian institutional fishermen and the importation of turtle-shell and turtle-rings from Dilmun. The main body of Babylonian material consists of texts, primarily economic documents, but also literary and lexical texts as well as some iconographical representations. In the texts two \*types\* of turtle are distinguished: even though there are some indications about the nature of the distinction between the two types, there is little agreement on the exact meaning of these terms. However, by combining a wide range of contemporary material an attempt can be made to offer a plausible identification: the terms probably correspond to two species of aquatic sweet-water tortoises rather than marine turtles. This interpretation is in accord with what we know about the Babylonian fishermen and leads to a different interpretation of a specific kind of fishermen.

**Keywords:** Turtles, Bronze Age, Archaeology, Assyriology

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## OLSEN, S.

### *Horned Horses, Griffins, Sphinxes, and Other Sacred Beasts in Kazakh Prehistory*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Evidence for sacred beasts in Kazakhstan emerges at least by the Eneolithic period, ca. 3500BC and reaches its zenith in the Iron Age. The Botai culture of northern Kazakhstan provides the earliest evidence for ritual treatment of animals, including horses, dogs, wild carnivores, and possibly aurochs. At this stage, osteological deposits indicate that animals retained or acquired symbolic meaning after their death. The significance of the Botai practice of decapitating carnivores, such as wolves, foxes, and wolverines, and burying the heads separately from their bodies is still obscure, but other religious rituals may be partially interpreted through their persistence into historical times. Dogs and dog skulls were buried on the west sides of houses in ritual pits, possibly to act as spiritual guardians at the home's threshold. The association between dogs and western entrances continued into Indo-European and Indo-Iranian religious texts as two dogs were thought to guard the gate into the Afterlife, which laid to the west. Dog sacrifices appear at western entrances from China to England in later times. At Botai sites, horse skull masks were placed along with other sacred items in deep pits around the exteriors of pithouses. Horse phalanges, some of which were ornately incised, were gathered in house floor cache pits. Horses were sacrificed and buried with humans from the Eneolithic on. In the Bronze Age, head and hoof burials of horses, sheep, and cattle accompanied human burials. Bronze Age petroglyphs feature horned horses associated with sun gods. By the Iron Age, mythical beasts such as horned horses, griffins, and sphinxes, emerge as regal symbols and become salient features of kurgan burials.

Headdresses found on stallions in the frozen tombs of Pazryk, in Siberia, and Berel, in Kazakhstan, were mounted with artificial antlers or ibex horns in an attempt to convert normal houses into heavenly beasts. Gilt-covered wooden carvings of felines, sphinxes, and griffins adorned the bridles of the sacrificed horses in the Berel tomb. A gold bas relief effigy plaque of two horned horses, back to back, appears on the headdresses worn by an important male known as the Gold Man of Issyk. Although there will always be much that remains shrouded in mystery, recent research is beginning to piece together the roles played by mythical beasts in Central Asia's ancient religions. Our results demonstrate the importance of close examination of osteological remains in pits, as well as burials and houses. The best hope for gaining knowledge about mythological bestiaries relies on a combination of skeletal and artifactual animal representations.

**Keywords:** Kazakhstan, mythology, griffin, unicorn, sphinx

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### **ORCHARD, T.J.**

**Poster:** *Fish size in prehistory: the case of prehistoric Aleut subsistence*

**Session:** General

**Abstract:** The detailed reconstruction of the size of fish specimens can provide methodological aid as well as contributing directly to the analysis and interpretation of faunal assemblages. Statistical regression was applied to the comparison of skeletal element size and the live length and weight for comparative specimens of six fish taxa: Pacific cod (*Gadus macrocephalus*), Walleye pollock (*Theragra chalcogramma*), Atka mackerel (*Pleurogrammus monoptyerygius*), Greenling (*Hexagrammos* sp.), Rockfish (*Sebastes* sp.), and Irish Lords (*Hemilepidotus* sp.). These taxa were chosen based on their prevalence in archaeological faunal deposits from the study area. The resulting regression formulae were then applied to the analysis of fish remains from five sites on Adak, Buldir, and Shemya Islands in the Aleutian archipelago. Size estimates made two major contributions to the analysis of the fish remains from these sites. First, a methodology was created to use the detailed length estimated to aid in the determination of minimum numbers of individuals for each taxon. In addition, estimated weights provided direct insight into the subsistence of prehistoric Aleut populations and into temporal changes in the local ecology.

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### **ORCHARD, T.J. & MACKIE, Q.**

**Poster:** *Environmental archaeology in Gwaii Haanas: preliminary results and future prospects*

**Session:** General

**Abstract:** Fieldwork conducted in Gwaii Haanas (Queen Charlotte Islands, British Columbia) during May and June of 2000 was aimed at environmental reconstruction for the period of European contact, a time characterized by rapid and substantial environmental changes. Environmental remains were recovered through a program of small-scale excavation and testing at three sites in eastern Gwaii Haanas. This poster provides an outline of the archaeological fieldwork and analysis that has been completed to date. In addition, to exemplify the potential for environmental interpretation, archaeological evidence is described that relates to the extirpation of the sea otter during the maritime fur trade and the resulting impact on ecologically related species such as abalone, sea urchin, and kelp-dependent fish. This case study demonstrates that archaeological analysis can provide a picture of the past environment that is not readily available through other sources of data.

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### **ORR, K.L.**

*Archaeological Fish Otoliths as Retrospective Indicators of Coastal Ecosystems*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Recent research indicates that global fisheries are in a state of crisis, presumably due to the consequences of overcapitalization. Disturbance to coastal ecosystems dates back several centuries, yet coastal ecosystem management, policy-making, and research is largely based on modern short-term ecological studies. Zooarchaeological data provide the historical perspective absent from ecological investigations, and can link modern environmental problems to historical antecedents. Zooarchaeological research in Spanish Florida indicates that coastal resources were altered beginning in the early colonial period. However, the drivers of palaeoenvironmental change are difficult to disentangle. Due to the unique characteristics of fish otoliths, these skeletal elements represent an important source of palaeoenvironmental data. The results of the faunal analysis from Nombre de Dios, located in St. Augustine, Florida, indicate that the inhabitants relied heavily upon sharks, rays, and bony fishes. Analysis of archaeological otoliths from Nombre de Dios indicates a reduction in the size of sea catfishes (Ariidae) through time. Otolith studies are conducted to determine whether or not modification of coastal resources can be attributed to natural patterns of climatic variance, rather than human induced stimuli such as overexploitation. This research is part of a larger study intending to correlate growth increment data with stable isotope analyses as a proxy of climatic variance over the past 500 years in this region. Archaeological fish otoliths provide the palaeoenvironmental data necessary to establish a reference



point from which subsequent disturbance to this coastal ecosystem can be measured.

**Keywords:** Spanish Florida, palaeoenvironmental studies, fish otoliths, growth increment analysis, stable isotope analysis

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**OUESLATI, T., MARQUIS, P., ROBIN, S. & MATTERN, V.**

*A multidisciplinary approach towards the definition of the status of the Gallo-Roman city of Paris*

**Session:** Integrating Zooarchaeology

**Abstract:** The purpose of this communication is to introduce a multidisciplinary study of the Roman town of Paris between the end of the 1st c. BC and the end of the 4th c. AD. Activities taken into account are those documented by ceramics, plaster, wall paintings and biological remains. The animal bones of ten habitat sites shed the light on meat consumption within the domestic unit and the distribution of meat and animals within the town. A deposit assimilated to refuse of cattle butchering activities is the proof of the existence of a large-scale animal processing activity during the third century. The 65,000 bone remains examined in this respect clarify not only the provisioning of the town with animal products but also their use at the domestic scale for food and other purposes. The study of charred vegetal remains completes our image of food provisioning, distribution and consumption. In addition, relevant data about economic trends, cultural change and handicrafts' organisation has been recently gathered through an analysis of the production of amphorae and jugs dating of the third century. These were associated both with local wine production and distribution inside the Parisian civitas, and also with the inter-provincial trade of wine as early as the third century BC. Common domestic ceramics, which are the second type of products manufactured for certain within Lutèce played an increasingly important role through the occupation of the site as opposed to the imported vessels including those that carried imported goods. By these aspects, the pot production in Roman Paris is giving elements of understanding, if not explanation, of what may have been the major functions of the Roman city. The compilation of these data, to which we will add data about plaster production and wall paintings, leads to an understanding of the status of the town and its inhabitants.

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**OUTRAM, A.K.**

*Identifying Dietary Stress in Marginal Environments: Bone Fats, Optimal Foraging Theory and the Seasonal Round*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** The exploitation of bone fats is a very familiar practice in marginal environments, particularly cold ones. However, bone fats are exploited to different extents by different peoples. Intensive bone fat exploitation is an inefficient process. By identifying the level of intensity of bone fat exploitation it may be possible to identify levels of dietary stress. This issue will be discussed with reference to Optimal Foraging Theory and seasonal variations in the economy. Examples will be from drawn from England, Greenland, Iceland, Sweden and the Italian Alps.

**Keywords:** fat, bone marrow, bone grease, season, optimal foraging theory

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**OUTRAM, A.K.**

*The Identification of Levels of Bone Marrow and Grease Exploitation and the Place of Bone Fats as a Resource within Seasonal Rounds: Case Studies from Greenland and Sweden.*

**Session:** Animal Fats and Oils

**Abstract:** The methodology employed for establishing levels of bone marrow and grease exploitation from the detailed study of bone fracture and fragmentation is outlined. Results from the analysis of bone assemblages from of two Norse settlements on Greenland (Sandnes and Niaquussat) and from Ajvide, a Middle Neolithic site on Gotland, are discussed. Much previous palaeoeconomic work has been carried out on these sites and there is a fair level of certainty regarding the seasonal scheduling of resource exploitation by their occupants. As such, the level and nature of bone fat exploitation is discussed in relation to the different, seasonally varying needs for sources of fat within the economies of these sites. It becomes clear that it is not just the nature and abundance of resources available to a people that affect their exploitation of bone fats, but also the timing of their availability.

**Keywords:** Bone Marrow, Bone Grease, Fat, Season, Diet

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### **PALMER, C.**

*Fat Stores: Clarified Butter and Milk Processing in the Near East*

**Session:** Animal Fats and Oils

**Abstract:** Milk products in pastoral groups managing sheep and goats contribute *ca.* 70 to 79% of calorific intake, according to calculations by Russell (1988, 74). Clarified butter or ghee (*samn* or *samma*) is the most highly prized of milk products and its inclusion in any dish makes that food 'special'. This paper describes the milk processing sequence used by bedouin and village populations in Jordan, focusing on products with lengthy storage capabilities, such as clarified butter. The archaeological visibility (and invisibility) of the process is also considered. Although the milking season can be extended for up to six months through the spacing of births, the preparation of storable milk products is an important activity and, in the past before refrigeration, was an essential one. Only the best quality milk produced during the short season of fresh spring grazing can be used to make the most highly valued products. The processing of these milk products is traditionally part of the women's domestic domain, but home production has decreased considerably in recent times. Olive oil is now frequently used in cooking and for flavouring food where clarified butter was once preferred. There has been a profound shift in the rural diet over the past 50 years and some traditional foods using clarified butter, and their social context, are described as part of this contribution.

Russell, K. (1988) *After Eden: the Behavioural Ecology of Early Food Production in the Near East and North Africa*. British Archaeological Reports International Series 391: Oxford.

**Keywords:** milk products, fermentation, clarified butter, Jordan

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### **PALOMBO, M., BARBIERI, M. & FILIPPI, M.L.**

**Poster:** *Microwear and Isotopic analyses on teeth of late Middle Pleistocene Elephas antiquus from the Latium (Italy)*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** In the last few decades, new approaches have been developed to help define the palaeoecology of Cenozoic vertebrates taxa and research on the dietary habits of extinct herbivorous has given valuable insights into palaeovegetation and palaeoclimate. The most useful method for paleodietary reconstruction is to compare results of microwear and stable isotope analyses (carbon, oxygen, and strontium) performed on tooth enamel. The dietary habits of large mammals can be deduced from microscopic scars (tooth microwear) on tooth enamel resulting from direct contact between food and tooth, or between tooth and tooth. Isotopes in herbivores provide information not only on the isotope composition of body water and, indirectly, on climate (oxygen of phosphates), but also on prevalent diet and, therefore, typical vegetation (carbon on structural carbonate in bio-apatite). Moreover, strontium isotope geochemistry may yield environmental information on the substratum the studied taxa were living on. Consequently, stable isotopes geochemistry and microwear studies in combination can produce additional interesting information for paleoclimatic and paleoenvironmental reconstruction. This paper will present research undertaken on *Elephas antiquus* molars from rich vertebrate deposits of the late Middle Pleistocene of Latium. There is quite good correspondence between isotopic and microwear analysis: the microwear analysis results are consistent with the hypothesis that late Middle Pleistocene *Elephas antiquus* had a predominately browser-intermediate type of diet; carbon isotope measurements on structural carbonate of biogenic apatite (enamel) suggest a mainly C<sub>3</sub> diet; strontium isotope composition ( $^{87}\text{Sr}/^{86}\text{Sr}$ ) confirms that the life area was limited to the volcanic provinces.

**Keywords:** Stable isotopes, Dental microwear, *Elephas antiquus*, Middle Pleistocene, Latium

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### **PASDA, K.**

*Taphonomic investigations on reindeer in West Greenland*

**Session:** Taphonomy

**Abstract:** Throughout an archaeological survey over two years in the inland tundra of Central West Greenland taphonomic investigations on naturally died reindeer have been done. Carcasses, skeletons and single bones were documented. 1. A comparison of demography and spatial distribution of reindeer skeletons indicates good correspondence with investigations of the living reindeer population. No wolves, polar bears, wolverines and rodents live in the investigated area. The carcasses are defleshed by Arctic foxes and ravens mainly. This leads to a typical disarticulation sequence of the skeletons. Some skeletons which were documented in the first year were revisited 12 months later. It appeared that under these circumstances the

natural process of disarticulation is slow and skeletal decay lasts over many years. 2. Arctic foxes and ravens are not able to destroy massive bones but may transport single bones and skeleton parts away. This activity causes typical distributions of skeletal elements in the tundra, below stones and in front of polarfox dens. 3. The understanding of decomposition and sequence of disarticulation of reindeer skeletons in an arctic climate may help to interpretate palaeolithic bone assemblages of Central Europe. This shall be shown by an example: The results of the non-human influenced bone accumulations in West Greenland will be compared with archaeological material from Germany and West Greenland.

Pasda, K., Zur Taphonomie von Rentieren (*Rangifer tarandus groenlandicus*) in der Tundra Westgrönlands. *Quartär*, 51/52, 2001, 173-194.

**Keywords:** Taphonomy, West Greenland, Reindeer, Natural decay, Polarfo

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#### **PATOU-MATHIS, M.**

*Subsistence behaviours in Middle Palaeolithic site in Poland : the Raj Cave*

**Session:** Neanderthal ecology

**Abstract:** This paper presents a short overview of mammal remains from one of the most important Middle Palaeolithic archaeological sites in Poland : Raj cave. This site lies near Kielce. Archaeological materials in cultural layers 4 and 6 are described as belonging to the Charentian culture. The stratigraphic sequence in its entirety may have settled during the Interpleniglacial Wechsellen, equivalent to isotopic stage 3. Level 4 would correspond at maximum to an interstadial phase and level 6 to a stadial one. The environment of level 4 was mixed, prairie and woodland, and the climate was relatively temperate and humid. In level 6, the forests regressed while the steppe increased, and the climate became cold and relatively dry. In the lower level (layer 4) cave Bear (*Ursus spelaeus*) dominates carnivore remains. In the upper cultural level (layer 6), cave Bear and cave Hyena (*Crocota spelaea*) are the best represented carnivore taxa. In level 4, hunting appears diverse. On the other hand, in level 6 hunting seems to be oriented towards the Horse, but Reindeer and Bovids are relatively abundant. A large quantity of shed antlers was discovered in this level; the role of man as collector has yet to be proven. Clear evidence of human activities on the bone surfaces is very rare. Few cut marks are found on the bones. Raj cave can be considered as a seasonal camp, occupied during summer/autumn for level 6.

**Keywords:** Neanderthal, Middle Palaeolithic, Poland, Raj cave

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#### **PAVAO-ZUCKERMAN, B.**

*The deerskin trade at the Historic Creek Native American site of Fusihatchee*

**Session:** General

**Abstract:** Ethnohistoric evidence and archaeological observations of architecture, trade goods, and technology indicate that the Creek Native Americans of southeastern North America actively participated in the eighteenth-century trade in deerskins with English and French traders. However, direct zooarchaeological evidence for the intensification of the deerskin trade is rare in this region. The faunal assemblage from Fusihatchee, a Historic Creek village site located in present-day Alabama, changes substantially over time from the seventeenth to the eighteenth century. An increase in the representation of deer, a florescence of cut marks diagnostic of skinning activities, and a shift in deer skeletal portion recovery indicate that the village was heavily involved in the trade for deerskins, and that this involvement intensified over time.

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#### **PEACOCK, E. & RAFFERTY, J.**

*Using land snails to understand site formation processes: an example from the Southeastern United States*

**Session:** Archaeo-Malacology

**Abstract:** Terrestrial gastropod remains from archaeological contexts typically are used for environmental reconstruction. Less often, they are used to explore cultural and natural formation processes. Recent excavations at a number of Late Prehistoric and Protohistoric sites in north-central Mississippi, U.S.A., produced tens of thousands of land snail shells. The sites contained stratified pit features that are depositionally very complex. Degradation of other faunal remains and artifacts is measured and compared to land snail data to investigate the rate and nature of feature infilling at two sites dating from the mid-16th to mid-17th centuries A.D.

**Keywords:** land snails, formation processes, Protohistoric, Native American, southeastern U.S.

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**PÉAN, S.**

*New isotopic and zooarchaeological data about mammoth procurement during Mid Upper Palaeolithic in Moravia (Czech Republic)*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** Man-mammoth interactions in Palaeolithic are still highly debated. Three hypotheses can explain the setting of mammoth bone heaps: hunting, scavenging and bone collecting. These types of procurement have been alternatively overwhelmingly promoted. Large Mid Upper Palaeolithic open air sites, belonging to the Gravettian complex (~30,000-22,000 BP), have yielded such huge accumulations of mammoth bones, in Central and Eastern Europe. The Moravian site Milovice, in the Czech Republic, belongs to this type of deposit. The big mammal remains from the sector G were studied through both zooarchaeological and isotopic studies ( $^{13}\text{C}$ ,  $^{15}\text{N}$ ), in order to precise the palaeoecological background and the subsistence behaviours of the Gravettian settlers. Mammoth are represented by at least 21 individuals, mainly juveniles and young adults. Their skeletal preservation and taphonomical features refer to a death site where butchery was carried on. From the associated remains of reindeer and horse, the site seems to have been settled in late spring / early summer. Biogeochemical analyses were carried on bone collagen from herbivores and carnivores. Predator/prey inter-relationships were established between these species, notably wolf/horse and lion/reindeer. Mammoth have high  $^{15}\text{N}$  values, which could be linked to those recorded in contemporaneous human remains from geographically close sites, Dolní Vestonice I and Brno II (data from M. Richards et al.). Gathered zooarchaeological and isotopic results give new clues about mammoth procurement in Central Europe during Mid Upper Palaeolithic.

**Keywords:**

subsistence, Mid Upper Palaeolithic, Central Europe, mammoth, stable isotopes

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**PEARSON, J., RICHARDS, M.P. & HEDGES, R.E.M.**

*Isotopic evidence for herding strategy and plant exploitation in the Neolithic of the Near East*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** The ratios of stable carbon ( $\delta^{13}\text{C}$ ) and nitrogen ( $\delta^{15}\text{N}$ ) isotopes of osteological and botanical remains from

Çatalhöyük, a Neolithic site in south-central Anatolia, have allowed examination of plant exploitation and herbivory preference by animals in the Neolithic period of the Near East. This technique is used to suggest that both C3 and C4 plant formed different components of each individual animal's diet providing clues as to how they might have been managed and the environments from whence they came. This technique thus provides a powerful analytical tool when used in conjunction with morphological techniques. The presence of wild plants with distinctive  $\delta^{13}\text{C}$  values is identified as forming a variable contribution to the dietary protein source of particular animal species, with higher variability amongst domestic animals, compared with the wild taxa.

**Keywords:** Carbon isotopes, Nitrogen isotopes, Diet, Çatalhöyük

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**PETERS, J. & DRIESCH, A.E. von den**

*9th millennium BC ungulate domestication in south-eastern Turkey*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The shift from a hunting and gathering subsistence toward food production represents a major cultural development in the history of mankind. Based upon recent archaeo(zoo)logical work in south-eastern Turkey and Northern Syria, it can be postulated that the 9th millennium cal. BC inhabitants of this region were among the first to adopt this new lifestyle, since the domestic forms of Ovis, Capra, Sus, and Bos occur at an early age compared with regions located to the east and south of the Upper Euphrates Basin. While the socio-cultural changes during the 11th and 10th millennia cal. BC, leading to more complex societies in the study area, conceivably provided the cultural background against which domestication of the ungulate taxa mentioned could take place, archaeozoologists still continue to speculate on why livestock came to be incorporated into the Pre-Pottery Neolithic economies of the Near East. Based on archaeozoological and palaeobotanical evidence collected along the Upper Euphrates, this change in subsistence strategy does not seem to have been triggered by large scale climatic change and/or landscape deterioration. This reinforces the assumption of socio-economic factors being primarily responsible for the shift toward an economy based on animal husbandry.

**Keywords:** Pre-Pottery Neolithic, Upper Euphrates, Domestication, Ungulates, Spiritual world

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**PETERS, J., BERKE, H. & KRÖPELIN, S.**

*Holocene faunal remains from the Eastern Sahara: Past and Future Zoogeographical implications*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** In the Eastern Sahara (c. 12° - 32° N - 15° - 30° E) three larger Holocene palaeodrainage systems can be identified. Up to 1400 km in length they were active between the 9th and the 2nd millennium cal. BC. Rivers, marshes, and lakes developed in a comparably short period of time, among them a palaeolake in West Nubia with a size up to 5330 sq. km. Because water tables had risen on a regional scale, the lakes and river channels (temporarily) became interconnected and could therefore act as migration paths for a wide spectrum terrestrial and aquatic (in)vertebrates. The analysis of archaeozoological samples and of taphocoenoses near ancient lake shores and along dried-up water courses has shown that the aquatic fauna is of nilotic origin. Environmental conditions also enabled terrestrial species to (re)colonise the Eastern Sahara, the number of species identified being considerable. According to latitude and Holocene period, the faunas reflect living conditions at present recorded in the southern Sahel and/or northern Sudan Savanna Zones. Of interest is the fact the faunal diversity seems to increase not only from North to the South but also from East to West. Species composition being indicative of palaeoenvironmental and climatic conditions, the northward extension of the biomes during the Early and Middle Holocene can be estimated. In view of a recent decision by the Sudanese Government in co-operation with the World Heritage Centre of the UNESCO to establish a 100 000 sq. km National Park in Northwest Sudan, the Holocene palaeofauna (and -botanical) record will be of particular interest when envisaging the re-introduction of species.

**Keywords:** Eastern Sahara, Holocene, palaeozoogeography, Wadi Howar National Park

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**PHOCA-COSMETATOU, N.**

*A Zooarchaeological Reassessment of the Habitat and Ecology of the Ibex (Capra ibex)*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Ibex is a species for which archaeological data can prove particularly pertinent in our understanding of the biology and behaviour of the animal today. This is principal because ibex faced near extinction in Europe at the end of the 19th century and its survival in the 20th century was a result of introductions and re-introductions of the animal by zoologists and ibex specialists in particular areas. Consequently, ibex habitat today can be considered in many ways a “modern-day human construct”. This paper will attempt to illustrate how an examination of archaeological and zoo-archaeological information can help us gain a better understanding of ibex habitat. Such archaeological data, coupled with a critical reading of the variables affecting modern ibex habitat, rather than relying simply on the formal description of its habitat, enables a new understanding and assessment of the animal itself. Moreover, it indicates how archaeology, with its long-term perspective, can be useful to zoologists by providing them with new insights. The case study used is based on our knowledge of ibex hunting and exploitation in Italy during the period of the Upper Palaeolithic (c. 40,000- 10,000 years ago). I will focus on sites with numerous ibex faunal remains, for these indicate a strong reliance on ibex by human hunters. These sites will be compared across such variables as their geographic location, their altitude and the then prevailing environmental conditions. The aim is to compare the archaeological data on ibex habitat in the past to our modern understanding of the species’ ecology. It will be argued that the modern understanding of ibex habitat in archaeology is derived from an uncritical acceptance that the animal inhabited the same type of terrain in the past as it does at present; a new understanding of ibex habitat will be proposed.

**Keywords:** Ibex, habitat, mountains, altitude, Italy, Upper Palaeolithic

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**PHOCA-COSMETATOU, N.**

*Bone weathering, fragmentation and past human activities: comparing six Italian Upper Palaeolithic faunal assemblages and the reliability of our behavioural inferences*

**Session:** Taphonomy

**Abstract:** In this paper, I will discuss which aspects of a faunal assemblage are most directly affected by taphonomic processes and propose others which can more reliably be explained in terms of past human behaviour. For this purpose I will compare six faunal assemblages from Italy, dating to the Upper Palaeolithic. The assemblages will be initially compared as to the extent and types of natural modification they have undergone, including such variables as erosion, staining, concretions, flaking, root etching etc. I will then proceed to explore to what extent the weathering of each assemblage has had a direct effect on those aspects of the faunal assemblages which can potentially be interpreted as reflecting past human behaviour. Such aspects include the types of bones recovered, the extent of fragmentation, and the frequency of tool cut marks. It will be argued that some of these aspects are directly, and almost solely, affected by taphonomic processes, whereas others seem to be unaffected by them; these latter ones can, consequently, be explained in behavioural terms. This paper thus aims to illustrate how a taphonomic analysis of animal bones can be directly incorporated into a meaningful discussion of past human behaviour and hunting activities.

**Keywords:** Italy, Upper Palaeolithic, weathering, food procurement strategies

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### **FIGIÈRE, F. & BOONE, I.**

*Status as reflected in food refuse of late medieval noble and urban households at Namur (Belgium)*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** The archaeozoological data base available for the late medieval and post-medieval period of the town of Namur (Belgium) allows the analysis of consumption patterns of different social groups and of the expression of their status through diet. Three sites situated at the confluence of the rivers Sambre and Meuse are considered for this analysis, the feudal settlement "Château des comtes", the middle- and lower-class houses at the Grognon and the hospital "Saint-Gilles". Moreover, historical data giving information about the inhabitants of these sites are confronted with the archaeozoological results. We integrate in this study the general historical data concerning food and its acquisition in medieval and post-medieval times, but also those available about the food supply at Namur. The analysis takes into account environmental

and politico-economic influences on the diet throughout the period considered. Differences in the dietary patterns are investigated through the composition of livestock (proportion of species, age at death and skeletal element distribution), the other species represented, the proportion of small and large game, marine and local fishes, and the presence/absence of luxurious and prestigious species.

**Keywords:** Namur, Belgium, late medieval, consumption patterns, status

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### **PIKE-TAY, A.**

*From Reindeer to Wallaby: uncovering patterns of seasonality, mobility, and prey selection from 35, 000 BP*

**Session:** Neanderthal ecology

**Abstract:** The murky biological status of Neanderthals has inspired many behavioural paradigms. We ask if it possible to differentiate behavioural changes in an evolutionary sense (archaic to modern) from innovative/evolutionary changes in behaviour due to local adaptation to a changing environment? Our approach to Neanderthal ecology is comparative. Both lithic and faunal analyses of Pleistocene Tasmanian sites dating back to 35, 000 BP show patterns very reminiscent of Middle Paleolithic Eurasia. Yet, Australia was first populated by anatomically modern humans. That these people exhibited modern cultural behaviour is supported, among other things, by the fact that they crossed from South-East Asia to Greater Australia by boat. If the Tasmanian archaeological sequence parallels that of the Mousterian, then the earliest Aboriginal colonisers of Greater Australia were either archaic in a behavioural sense (a view inconsistent with the level of technology necessary to undertake such a colonisation and the speed with which they adapted to a wide range of environments) or the interpretation of what indicates archaic behavior must be reassessed. Results from skeletochronological studies (specifically, dental growth-increment analyses) of large game from Franco-Cantabrian Palaeolithic sites suggest shifts in mobility and subsistence strategies. Compilation of control samples of teeth of recent animals (e.g., *Cervus*, *Rangifer*, *Equus*, *Capreolus*, *Bos*) of known-age and date-of-death has been requisite to these growth-increment studies. Here we present results from the recently compiled control sample of modern Tasmanian Bennett's wallaby (*Macropus rufogriseus*). Then, along with the ageing techniques of molar progression and tooth eruption and attrition, we apply skeletochronological analysis to Bennett's wallaby from Tasmania's earliest sites. We expect these data to support more robust hypotheses of both mortality patterns and seasonal hunting patterns of this principle macropod prey species, as well as consideration of the question of "archaic" versus "modern" ecological adaptations.

**Keywords:** archaic humans, dental increment studies, macropod aging techniques, seasonality, Tasmania

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**PLOGMANN, H.H., HAGENDORN, A.  
& JACOMET, S.**

*Unspecified Roman pits: An interdisciplinary excursion  
to identify the use of pits in Vindonissa (Windisch)  
/Switzerland.*

**Session:** General

**Abstract:** During the excavation (Windisch-Breite 1996-1998) of early roman contexts (pre legionary-camp-phases, second decade BC until about 15 AD; legionary-camp, phase of 13. Legion 15 until 45 AD) in Vindonissa several pits of unknown use came to light. They were situated as well in and outside of buildings. Especially the use of some barrel-pits dating to the first decade BC was difficult to interpret. On the first sight the contents of the pits seemed not different from the burned layer surrounded. Beside that the archaeological features were not definite from the beginning. The structures could be interpreted either as latrines, cellars, rubbish deposits or craftsmen facilities. Only an integrated team of archaeologists, archaeobotanists and archaeozoologists together came to surprisingly corresponding results, which will be presented.

**Keywords:** integrated archaeology, roman camp, barrel-pits, fishes, fruits.

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**PLUG, I.**

*The Exploitation of Freshwater Fish during the Later  
Stone Age of Lesotho*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Exploitation of inland fish resources in the southern African Later Stone Age only became significant from approximately 5 000 BP, much later than that of marine fish resources. Fish remains are usually additional to the dominant remains of mammalian and reptilian fauna. However, at Likoaeng, an open air site on the Senqu River in Lesotho, the focus was mainly on fish. Due to the cold and harsh winters of the area species are limited and only four suitable for exploitation occur. They are: *Labeobarbus aeneus*, *Labeobarbus*

*kimberleyensis*, *Austroglanis sclateri* and *Labeo capensis*. The first is currently the dominant species in the river. *L. kimberleyensis* is a large predator and is not common. *Austroglanis* is a rock catfish with specific habitat requirements, it is scarce today and was probably never common. *Labeo capensis* is fairly common. It is an alga- and mud-eater and is seldom caught with line and hook. The Likoaeng samples consist almost exclusively of adult *Labeo capensis* of fairly similar size. Youngsters are poorly represented. The profile indicates that *L. capensis* were caught during their annual spawning run when they congregate. The river at Likoaeng has a large boulder and gravel fan where a tributary, the Sehonghong, meets the Senqu. The limited numbers of *Labeobarbus aeneus* supports this hypothesis. The few other fish remains identified are some *Labeobarbus kimberleyensis* and a few isolated *Austroglanis* specimens. I suggest that *L. kimberleyensis* the predator, preyed on the congregating *Labeo* and were opportunistically caught by the fishers. The fishing techniques would have been baskets, some form of net, by hand and spearing. A few skull elements show round holes as if the fish was speared through the head.

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**PÖLLATH, N.**

*Ichthyological diversity and palaeoecological  
interpretation of fish remains from the Wadi Howar  
Region, Northwest Sudan*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Based upon scientific work by members of the University of Cologne, it has been shown that the remotest areas in north-eastern Africa witnessed an intense prehistoric human occupation during early and middle Holocene times. Settlement patterns correlate well with the availability of surface water, water bodies including rivers, lakes, and marshes coming in existence during the 9th millennium cal. BC and lasting until the 2nd millennium cal. BC. In north-western Sudan the Wadi Howar can be considered the most important hydrogeographic feature of the recent past. It was the largest tributary of the Nile, originating in the region between the Ennedi Plateau and the Jebel Marra mountains. Archaeoichthyological research indicates that during the Early Holocene the wadi served as a migration path by which Nilo-Sudanic fish could spread to the West. During phases with exceptional high rainfall, fish species could even reach the upper Wadi Howar region, because then the different wadi sections were interconnected. The fish bone samples examined belong to sites located near two different types of aquatic biotopes, i.e. riverine and lacustrine ones. From the ecological demands of the fish species identified, information concerning the hydrological conditions prevailing at the time the sites were occupied, the topography of the water body, and the

water chemistry can be deduced. Samples have also been compared with ichthyofaunal assemblages from sites in the Central Sudanese Valley in terms of size distribution, species composition, and species diversity. In view of the future creation of a Nature Reserve in the Upper Wadi Howar region, these data will be relevant when considering a re-introduction of aquatic vertebrates species into the existing water bodies.

**Keywords:** West Sudan, Holocene, archaeoichthyology, Wadi Howar Nature Reserve

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### POTTER, J.

*The zooarchaeology of ritual-based social differentiation: patterns from the Zuni region of the American Southwest*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** This paper will present zooarchaeological data that illuminates economic, social, and ritual practice within and among six large, aggregated pueblos. Patterning in the fauna suggests the presence of communal feasting within plazas, the consolidation of ritually important species within villages through time, and increasingly uneven distributions of highly valued hunted meat within villages. These patterns coincide with intensified communal hunting of large game. It is suggested, drawing on ethnographic data from historic Zuni and Hopi, that the uneven distributions of large game were associated with the centralized control of ritual knowledge related to organizing communal hunts.

**Keywords:** Ritual, feasting, Social Differentiation, American Southwest, Hunting

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### POULOS, A. & ZEDER, M.

**Poster:** *The hunting of Gazella subgutturosa by early domesticators in the fertile crescent: a comparison of wild and domestic animal remains in the archaeological record*

**Session:** General

**Abstract:** The method of developing sex-specific age curves for domestic goat and sheep-remains from archaeological sites has

proved valid in identifying kill-off profiles that are representative of either domestication or hunting practices of people 10,000 years ago. The application of this technique to the study of wild, hunted gazelle remains has further reinforced the potential for metric studies based on sexual dimorphism and fusion rates. Modern specimens of *Gazella subgutturosa* were measured as a calibration of the degree of sexual dimorphism in the species. Sexual dimorphism proves to be a dominant factor in the size of various bones. Regional variation is also strongly prevalent in the specimens; however, the male to female ratio remains consistent and replicates the ratio of sexual dimorphism in modern sheep and goat as found by Dr. Melinda Zeder. This regional variation is present in the archaeological record as well. Thousands of gazelle specimens were analyzed from archaeological sites throughout the highland and lowland regions of the Zagros in Iran - Ali Kosh, Sarab, and Guran. A comparison of the sex-specific survivorship curves derived from the archaeological data of hunted gazelle with that of domestic remains is a startling contrast. Domestic goats and sheep replicate a similar pattern of domestication practice to that of the previously studied site of domestication, Ganj Dareh, whereas the hunted gazelle specimens give strong evidence for a different criteria in selection. The hunter's method of selection seems to be a trend for the selection of bigger and older males, interspersed with female and young, which contrasts with the domesticator's kill-off of young males as a means of maintaining the herd's life longevity. This technique allows for an earlier recognition of domestic remains without dependence on physical characteristics, and also sheds light on the exploitation of other food resources, namely the gazelle.

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### POWELL, A.

**Poster:** *Classical use of weasels to control pests*

**Session:** General

**Abstract:** Recent excavations at Pompeii by Reading University and the British School of Rome have uncovered evidence of weasels (*Mustela nivalis*) being used to control vermin at a time when cats may still have been relatively rare in Italy. The evidence is described and references to weasels in ancient sources examined.

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### POWELL, A.

**Poster:** *The impact of human colonization and trade on the zoogeography of the eastern Mediterranean*

**Session:** General



**Abstract:** One of the many areas of past human activity on which zooarchaeology can shed some light is human impact on the biogeography of a region. Humans have been transporting animals around the landscape for millennia, both deliberately, in the case of domestic livestock, companion animals and chosen game species, and inadvertently, as with the spread of *Mus musculus* and *Rattus rattus*. A current project at York aims to use archaeological evidence to shed some light on the role of humans in spreading a suite of small mammal species through the islands of the eastern Mediterranean.

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**PRIVAT, K., O'CONNELL, T., NEAL, K. & HEDGES, R.**

*Is palaeodietary analysis not cheesy enough? An isotopic investigation of fermented dairy products and repercussions for dietary studies of ancient populations*

**Session:** Milk, Milking and Dairying

**Abstract:** When analysing potential food sources for ancient humans, current palaeodietary research considers an animal's body proteins (e.g., meat, bone collagen, milk) to be isotopically equivalent. The isotopic composition of archaeological bovid bone collagen is thus held to represent the isotopic composition of all the potential foods that could have been derived from that animal. Although a  $\delta^{15}\text{N}$  food-to-consumer enrichment has been observed in muscle tissue, bone collagen and milk, no studies have yet examined whether or not fermented dairy products (such as cheese, kumys and kefir) can be considered isotopically equivalent to the source animal's milk and other body proteins. The isotopic difference (or lack thereof) between milk and the fermented dairy products derived from it must therefore be investigated in order to properly interpret archaeological human isotopic values in terms of palaeodiet. An awareness of a milk-dairy product isotopic difference is particularly important when studying archaeological cultures that may have consumed a high proportion of fermented dairy products. This paper reports on a series of isotopic ( $\delta^{15}\text{N}$ ) analyses of dairy products (cheese & kefir) and of the milk from which these products were made. This research was designed to test whether or not the  $\delta^{15}\text{N}$  values of fermented dairy products differ significantly to the  $\delta^{15}\text{N}$  of their source milk. Our results are discussed in the context of a palaeodietary study of Bronze Age and Iron Age Eurasian steppe communities.

**Keywords:** dairy products, palaeodiet,  $\delta^{15}\text{N}$

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**PRUMMEL, W.**

*Bronze Age dog cremations and inhumed dogs from Borger, the Netherlands, and Dimini, Greece*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** This paper discusses two Bronze Age human burial sites with annex-burials of dogs: one in the Netherlands (Borger), and one in Greece (the Lamiospito at Dimini, Thessaly). Near Borger (province of Drenthe, the Netherlands) two Middle Bronze Age cremation urns were found next to a Middle Bronze Age burial mound. Urn 1 contained the calcined remains of the forepaws of a large dog. Urn 2 contained the calcined bones of a child and a dog. Child and dog were obviously cremated together and their ashes put into the same urn. The first urn may also derive from cremation of a human and a dog. The Borger urns are  $14\text{C}$  dated at  $3065 \pm 40$  (Urn 1) and  $3045 \pm 40$  BP (Urn 2), (1430-1210 cal. BC, and 1410-1210 cal. BC respectively). The Lamiospito near Dimini is a Late Bronze Age vaulted tomb, which is dated to the Late Helladic IIIA2 period (second half of the 14th century BC). Two pits with unburnt dog bones have been excavated within this large vaulted tomb. The dogs were grave goods for deceased elite persons. Examination of the bones showed that five dogs are represented in Pit 1, and at least three in Pit 2. One of the dogs in Pit 2 was a male (baculum). Most skeletons are incomplete. The pits presumably contain the remains of several dog inhumation burials that were reburied after rearrangements of the inhumed humans and dogs. The dog burials of Borger and Dimini are more or less contemporaneous. This paper will end with a discussion on general features of the use of dogs in funerary contexts in the 14th through 12th centuries BC in Europe, with an emphasis on the Netherlands and Greece.

**Keywords:** Burial mounds, dog burials, Middle/Late Bronze Age, Borger (Netherlands), Dimini (Greece)

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**PRUMMEL, W.**

*Marine and terrestrial molluscs from Neolithic, Bronze Age and Hellenistic sites in the Almirós and Soúrpi plains (Thessaly, Greece)*

**Session:** Archaeo-Malacology

**Abstract:** Mollusc shells are discussed from the Early and Middle Neolithic site of Karatsádhagli, the Middle Bronze Age Magoúla Pavlína, the Hellenistic town of New Halos and slightly later Hellenistic dwellings at the former southeastgate of New Halos. These four sites were all within 20 km of the coast of the Pagasitikós Gulf. Marine mollusc shells predominate in the four sites. Some terrestrial mollusc shells have been found in the two Hellenistic sites. Consumption as food was the main

goal of shellfish gathering in the four sites. Most consumed shellfish was of marine origin. Shells were used to make beads during the Hellenistic period. A holed *Luria lurida* functioned as a pendant in the dwellings at the former southeastgate of New Halos. No proof was found for bead or bangle production in the Neolithic and Middle Bronze Age sites. A positive correlation appears to exist between the distance to the shore (20 km for the Neolithic site, less than 2 km for the Middle Bronze Age site and the Hellenistic sites) and the consumption of marine molluscs. A second positive correlation was found to exist between the lagoonal (during the Middle Bronze Age) or open sea (during the Neolithic and the Hellenistic period) character of the coastal waters and the valve wall thickness of *Cerastoderma glaucum* (lagoon cockle). A negative correlation exists between the gathering pressure on marine molluscs (low during the Neolithic, the Middle Bronze Age and in the Hellenistic dwellings at the southeastgate, high in the Hellenistic town of New Halos with its large population) and the size of the consumed shellfish.

**Keywords:** Molluscs, Thessaly (Greece), type of water, gathering pressure

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#### **PRUVOST, M. & GEIGL, E-M**

*Palaeogenetic Study of the Domestication Process of Cattle in Europe*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** Archaeozoology is a key complement to any archaeological study. However, palaeontological determination of species and sex of faunal and human remains can become impossible when fossils bones are partially burned, compressed, chewed or otherwise morphologically destroyed. Palaeontological species determination can also be impeded by pronounced morphological sexual or intraspecies polymorphisms. In these cases, analysis of preserved biomolecules can lead to an exploitation of the information hidden in the fossils. Indeed, recently analysis of small fragments of DNA molecules, sometimes preserved in fossil bones, teeth or faecal material, has made it possible to retrieve genetic information from faunal remains, thus allowing analysis of the phylogeny of extinct species, migrations of ancient populations, the domestication processes, sexing of individuals, determination of palaeonutrition and palaeopathology. However, due to technical difficulties that still persist for this kind of analysis, the practical impact of this discipline, palaeogenetics, has so far been a minor one. The domestication of the aurochs (*Bos primigenius*) is one of the most important acquisitions of man during the Neolithic. The process of domestication and the spreading of domesticated cattle throughout Europe are not completely elucidated yet. Juxtaposed to the archaeozoological hypotheses concerning this process, phylogeographical hypotheses emerged that were based on the study of genetic

markers in extant cattle and which did not reach the same conclusions concerning the centres of domestication. However, both approaches are subjected to interpretation biases: these are, in the case of the archaeozoological determination, the uncertainty of the morphological criteria underlying the distinction of female aurochs and male taurine bones; in the case of the genetic analyses, the extinction of the wild ancestor implies the lack of an affiliation link and the necessity to exclusively base the phylogenetic analysis on the controversially discussed hypothesis of the molecular clock. Sequence data obtained from a direct analysis of DNA that is preserved in Mesolithic and Neolithic aurochs and cattle specimens have the potential to contribute to a solution of the contradictions and to an answer to open questions in this discussion. We applied a new quantitative PCR technique to analyse mitochondrial DNA from 27 freshly excavated Neolithic cattle and aurochs bones from France. The benefits of a quantitative analysis to the assessment of the reliability of the results will be discussed as well as our preliminary sequence data.

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#### **QUIROZ, D**

*Relationships Between Sea Otters and Human Groups on the Araucanian Coast, Chile.*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Island Morhuilla is the name that receives today a small peninsula, located about 10 kms. to the south of Lebu [Arauco, Chile]. Its shape is almost circular and its surface is about 2.5 km<sup>2</sup>, with a maximum height of 32 m.s.n.m., connected to the continent for a small isthmus, very low and sandy [2 m.s.n.m], of about 800 meters wide. The oldest inhabitants in the sector [most of them of indigenous origin], remember that for tradition, it was said that, "this was before an island". Occasionally, they can see in the place, "some animals, that we call marine cats, that can cause a lot of damage in the fishing activity". As part of our archaeological investigations in the coast of Arauco, we have been working in a place denominated Le-2, located in the oriental part of the "island". In the carried out excavations we were able to find significant remains, although not very abundant, of small carnivorous that we initially identify as remains of otters. The site represents a specialized occupation of hunters, fishermen and marine collectors that it would extend for about 500 years, between the 3000 and the 2500 BC. The remains of fauna and lithic and bony devices founded, allowed us to define Le-2 as a camp of slaughter of marine wolves and penguins, where it was also carried out fishing works and gathering of shellfish. In this opportunity we want to revise the presence of remains of otters, and to evaluate their importance, as long as for the populations that occupied the site Le-2, as for the regional archaeological investigations. Although they are not significant quantitatively,

the presence of otters, cohabiting with the human populations, forces us to think about the types of relationships between otters and the human groups that populated the Araucanian coast, more than 5000 years ago.

**Keywords:** Sea Otters, Araucanian coast, Chile

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**QUITMYER, I.R., JONES, D.S. & ANDRUS, C.F.T.**

*Seasonal Shell Growth and Oxygen Isotopes ( $^{18}O$ ) in the Variable Coquina Clam, *Donax variabilis* Say, 1822: A Modern Analogue to Determine the Season of Resource Procurement during the Late Archaic Period of Coastal Northeast Florida, USA.*

**Session:** Archaeo-Malacology

**Abstract:** The variable coquina clam *Donax variabilis* Say, 1922) is a small bivalve mollusk that inhabits the sandy beaches of the littoral zone of the eastern United States. Late Archaic period (5000 BP – 2500 BP) people of northeast Florida exploited large quantities of coquina clams. Existing research suggests that coquina clams have a twelve-month life span and the ability to correlate shell size with the season of the year is a valuable tool in determining the season of resource procurement. In this inquiry we establish an analogue of modern annual shell growth with a morphometric study of a systematic monthly collection of coquina shells from northeast Florida. We analyze the oxygen isotopes ( $^{18}O$ ) of shell microsamples taken along the organism's major growth axis to determine changes in seawater temperatures that occurred through ontogeny. Our research shows that young coquina shells first appear in the winter season and eventually reach their maximum shell length in the late spring and summer. Population density declines during the autumn making way for the following year's progeny. The analysis of  $^{18}O$  reveals a profile that is consistent with seasonal changes in seawater temperature associated with the measured annual shell growth. When we apply the modern analogue of shell growth and  $^{18}O$  analysis to zooarchaeological shells from five Late Archaic period sites, we determine that coquina shells were being collected during the summer season. The data also show that coquina shells smaller than 10 mm in length are rare in the five Late Archaic period assemblages, suggesting use of fine mesh devices for coquina shells collection where small individuals would be allowed to escape and continue to grow. Furthermore, the zooarchaeological shells attain a length of around 22 mm, while modern specimens are rarely greater than 14 mm.

**Keywords:** Sclerochronology, *Donax variabilis*, Late Archaic, Florida, Seasonality

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**RABINOVICH, R.**

*Amud cave - a different Neanderthal occupation?*

**Session:** Neanderthal ecology

**Abstract:** The late Mousterian site of Amud Cave (dated ca. 70 - 55 ky) is situated on the margins of the Dead Sea Rift, about 5 km north-west of the Sea of Galilee. Lithic, sedimentological, micromorphological, phytolith and paleoanthropological studies have revealed one of the most unique southern Levantine Neanderthal occupations. The faunal spectra include the "typical" regional distribution of middle size mammals (gazelle and fallow deer) in addition to smaller, naturally distributed ones (e.g., rodents). Amud is a rare case, as carnivores are absent, thus allowing examination of the faunal remains without the need to consider carnivore disturbance. It is intriguing to consider why such a phenomenon may have occurred. In spite of the intensity of use of the cave and its multiple hearths, causing breakage to the bones, the human signature is very clear. Evidence of cut marks and marrow extraction of the artiodactyls species is very common. Recent study has exposed a certain variability between the occupation layers. Though, faunal remains reflect only part of the diet components, they do reveal aspects of human subsistence patterns and behaviours related to animal consumption. The variability of Mousterian lithic complexes has been extensively studied, but only lately have the faunal characteristics started to play an important role. Thus, modes of bone accumulation and dispersal in relation to Neanderthals are of great interest especially in the southern Levant where paleoecological conditions (less harsh climatic fluctuations) and the probable existence of another hominid species (i.e., *Homo sapiens*) differ from known European spectra.

**Keywords:** Neanderthal, Middle Palaeolithic, Levant, Near East, Amud

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**RABINOVITCH, R.**

*Methodical Butchery Patterns from the Acheulian site of Gesher Benot Ya'aqov (OIS 19, Israel)*

**Session:** General

**Abstract:** In the Levant, faunal studies have special importance regarding assemblages of Early- Middle Pleistocene since the numbers of faunal assemblages that are assigned to this period

are minimal. Moreover, the data is very fragmentary and do not allow a full-scale examination of the biostratigraphical and paleoecological record. The renewed excavations at the site of Gesher Benot Ya'eqov (henceforth GBY) and their faunal assemblages contribute much to clarify the ecological and the biological aspects (Acheulian times) during the interglacial times of OIS 19. The site of GBY is located in the Dead Sea Rift, Israel, a segment of the Great African rift system (Goren-Inbar et al., 2000). This part of the rift is commonly known as the 'Levantine Corridor' and yielded rich paleontological evidence for a multi-directional movement resulting in mixed Afro-Eurasian faunal components (Tchernov 1992a, 1992b.) and diverse anthropological indications of diffusion/migration waves out of Africa and into Eurasia (Goren-Inbar et al., 2000; Goren-Inbar and Saragusti, 1996). The fossil fauna include many taxa of mammals, birds, reptiles, fishes and invertebrates species. Most of the faunal remains were found in association with lithic assemblages and archaeobotanical remains, suggesting hominin occupation. Moreover, the faunal material include many broken, splinted pieces that are unfortunately in most cases, unidentifiable to species level but bear evidences of hominin activity. A major effort was undertaken in order to reconstruct the human activity as revealed in the splinters shapes and frequencies. Since post-depositional effects seem to have been minimal, we decided to try refitting of the broken bones, in an attempt at reconstructing the mode of animal exploitation. Cut marks and intentional breakage pattern were observed over the bones in repetitive anatomical locations, implying the possibility of in-situ butchering process. The existence of butchery evidences though rare are known from other early sites but the methodical, fine repetition of the patterns at GBY render a new consideration as for the abilities of the early hominids (hominin). Because of the GBY site location along the Rift Valley, an ancient root of migration and knowledge exchange, it is especially interesting to study these patterns and to compare them with other sites along this root.

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### **RACKHAM, D.J.**

*Comparative fragmentation between species and its significance.*

**Session:** Taphonomy

**Abstract:** For several years the author has used a method of diagnostic zone recording for the routine analysis of animal bone assemblages of all periods. Consideration of the multi-site data set that has accrued from these analyses shows that the fragmentation and survival of the bones of cattle, sheep and pig show significant variations between species and bone elements. These variations impact on considerations of the relative importance of these taxa, discussion of their skeletal part representation and the age structure of each taxa. The degree of fragmentation exhibited by the individual assemblages also

appears to reflect aspects of their taphonomic path. This suggests that even similar contemporary assemblages on the same site may produce different patterns as a result of these different taphonomic pathways. There is considerable scope for mis-interpretation of the bone assemblages as a result of these variations and intersite comparisons between assemblages studied by different authors could lead to completely spurious conclusions. A fragmentation analysis of each species and major bone groups can go a considerable way towards reducing these problems, identifying the impact of biases and establishing the suitability of the bone assemblages for interpretation or intersite comparisons.

**Keywords:** taphonomy, diagnostic zones, fragmentation, inter-species variation

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### **REDDING, R.**

*Breaking the mould: a consideration of variation in the evolution of animal domestication*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The explanation of the shift in human subsistence behaviour from hunting and gathering to food production is a focus of research for archaeologists. Our part of this ongoing research is the how and why of the shift in human subsistence behaviour from a strategy of hunting to one of animal domestication. I argue that most of the work on this shift has been limited by our view of the end points of the process. We seem to assume that the tactics of animal use that emerged by the end of the Neolithic are the goal of the process. Hence, the explanation becomes one of how to get from A to B. The evolution of any behaviour pattern is filled with "failed experiments". Humans were attempting to solve a subsistence problem between 15,000 and 9,000 BP in the Middle East. It is likely that strategies and tactics of animal use were used that were later abandoned or failed. Evidence for some of these will be briefly examined. By focusing on the emergence of domestication, i.e. tactics of animal use that characterize the Neolithic, we may be missing aspects of the process that are not only interesting but critical to building and testing explanations.

**Keywords:** Neolithisation, Middle East, Domestication, Process, Subsistence

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### **REITZ, E.J.**

*The use of archaeofaunal data in fish management*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** The potential of archaeofaunal data for providing an historical perspective to wildlife managers is intriguing. In our archaeological materials, we have a record of change and stasis in resource use and the resource base itself for much of the Holocene. This could be of great benefit to the conservation effort. Some cautions, however, are well-known to archaeozoologists; but these need to be repeated for the new audience of resource managers unfamiliar with the strengths and weaknesses of this unique record. In the context of these cautions, a review of environmental data from archaeological sites in Peru shows a change in the types of fishes present in these sites and the trophic level exploited between 7563 and 4550 B.P. The explanations for these changes could be methodological, environmental, or cultural. Stable oxygen isotopes clarify the boundary between changes stimulated by natural phenomena and those related to human behavior, though the archaeological record also poses problems for this line of research. Nonetheless, evidence for environmental change and for change in fish populations is found in these faunal assemblages. It seems likely that mid-Holocene changes in Ecuador and Peru are primarily human responses to climate change. This archaeological record also clearly shows the response humans made to a change in the preferred group of exploited fish species. Instead of conserving the previous targeted species, people turned to domestication of mammalian taxa in Peru; and today we are turning to aquaculture, essentially another form of domestication.

**Keywords:** marine economies, Peru, trophic levels, culture change, climate change

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### REYNOLDS, S.C.

*Craniodental variability in fossil and modern Equus burchelli from East and southern African Pleistocene sites*

**Session:** Equids in Time and Space

**Abstract:** The extant species of Burchell's zebra (*Equus burchelli*) is known from the Plio-Pleistocene sites of Eastern and southern Africa, where its members shared the landscape (both geographically and temporally) with our early hominid ancestors. Could changes in the craniodental morphology of *E. burchelli* shed light on the climatic conditions present during a crucial period in the evolution of our own species? Burchell's zebra also co-existed during the southern Africa Pleistocene with another fossil zebra, the giant Cape zebra, *E. capensis*. The terminal Pleistocene climate and vegetation shift that affected larger grazers in South Africa led to the extinction of this large Cape zebra, but had little effect on *E. burchelli*. The continued

survival of Burchell's zebra may be due to the variability inherent in this species. This is the first study of variation between fossil and modern populations of *E. burchelli* in East and southern Africa. Ansell (1971) recognized six living subspecies whilst various other fossil species have been lumped into this extant species (including the extinct quagga, as a subspecies of the modern form). Can the range of variation within this species explain why it has been so successful? Results on these investigations regarding the geographic and temporal variation of this species in East and southern Africa as well as the degree of sexual dimorphism in past and present *E. burchelli* will be discussed, as will the implications of this research on the biochronology and biostratigraphy of hominid sites in Africa.

**Keywords:** African Pleistocene, *Equus burchelli*, geographic variation, sexual dimorphism

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MOLLESON, T. & SCHIBLER, J.**

*Stable isotope evidence of Sus diets from European and Near Eastern archaeological sites.*

**Session:** Recent Advances in the Analysis and Interpretation of Animal Diet and Management

**Abstract:** Pigs, like humans, are omnivores, and therefore have a wide variety of dietary options. Stable isotope analysis of pigs from a number of archaeological contexts supports this, showing pigs had a wide range of diets. In this paper we will present stable isotope evidence of pig diets from various European and Near Eastern archaeological sites. Although the current dataset is small, there appears to be a general trend where pigs are mostly herbivorous in earlier periods and in mainly rural contexts, and become increasingly carnivorous in later periods and in urban contexts. It is likely that this relates to increased human control of pigs and pig diets through time.

**Keywords:** Stable isotopes, Diet, Pig, Europe, Near East

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## ROBEERST, A.

**Poster:** *Equids in the Roman World; the case of the missing hybrids from Roman Nijmegen (Ulpia Noviomagus)*

**Session:** Equids in Time and Space

**Abstract:** The poster will hopefully contribute to the discussion of the role that equids played in the various and complex parts of Roman society. As part of my PhD research on animal use in Roman Nijmegen, an analysis will be made from equid bone material originating from a huge refuse-dumpsite of the Castra (Legio X Gemina) and canabae legionis from the Augustian period and the first century AD. Up to now, very few attempts on distinguishing (archaeozoologically) between horse and hybrids have been made on material from sites in the Netherlands. As such, the results can be useful for other researchers in both Germany and Great Britain who concentrate on this issue as well. The poster will present some preliminary results, that will hopefully trigger an interesting discussion on the subject.

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## ROSSEL, S.

*Food for the Dead, the Priest and the Mayor: looking for markers of status and identity at the Middle Kingdom settlement at South Abydos, Egypt.*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** The faunal remains from South Abydos are discussed in relation to how faunal analysis can be employed in addressing issues of social status and identity in past societies. The Middle Kingdom site at South Abydos, Egypt, features the mortuary temple of king Senwosret III and an associated settlement, which includes the only example of a mayoral residence so far excavated in Egypt. The iconographic and textual records of the ancient periods in Egypt suggest that animal products were ranked by taxon – cases will be presented to argue this point. This proposition is tested archaeologically by studying the relationship between the composition of the faunal assemblage from South Abydos and its archaeological context. This paper reports how preliminary results of the faunal analysis show overall correspondence with the impressions derived from texts

and depictions. It is suggested that in the study of ancient Egypt faunal analysis is a potentially useful tool in the identification of social status.

**Keywords:** South Abydos, texts, iconography, faunal analysis, social status

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## ROWLAND, S.

*The Pearl Trade in the Arabian Gulf*

**Session:** Coastal Adaptations in Arid Environments

**Abstract:** The pearl oyster, *Pinctada radiata* (Leach, 1814), has been exploited since ancient times in the Arabian Gulf. In the Emirates, the earliest examples of pearls, complete and perforated, date from early 4th millennium BC graves. The Romans had a particular interest in the Gulf pearl trade, much of it centred on the emporium of Ed-Dur and, by 1154, the settlement of Julfar was described as a major pearling centre. The pearl trade was highly influential in the development of the major gulf towns, particularly Dubai, and by 1900 was worth over 1.3 million pounds. It defined an entire social order based on patterns of mutual dependence and obligation, fueling an economy that was otherwise at subsistence level in a marginal environment. This exploitation of a single marine faunal resource was part of a series of seasonally integrated activities such as fishing and date gardening that continued unaltered into the 1920s. Competition from Japanese cultured pearls destroyed the industry, creating recession and depopulation that lasted until widespread oil extraction in the 1960s. This paper seeks to review historical aspects of the pearl industry, with reference to the archaeological evidence while considering what questions should be asked of this material, and how they might be answered. Investigations by the Abu Dhabi Islands Archaeological Survey (ADIAS) over the last decade have found numerous middens of pearl oyster shells. One especially impressive example from the island of Abu'l-Abyadh was approximately 3km in length and over 30m wide. Relics of this nature indicate the sheer scale of the industry. Although the trade occurred throughout the Gulf, and for most of the industry's history modern state names and boundaries had no relevance, much of what is discussed here has been taken from the United Arab Emirates, particularly the emirate of Abu Dhabi.

**Keywords:** pearl oyster, trade, Abu'l-Abyadh island, Abu Dhabi, United Arab Emirates

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## RUSCILLO, D.

### *To Dye for: Reconstructing Murex Royal Purple and Biblical Blue*

**Session:** Archaeo-Malacology

**Abstract:** The manufacture of the 'Royal Purple' dye had a significant impact on the social and economic worlds of the Aegean Bronze Age. Reams of cloth and garments were traded and offered as tribute to courts and shrines. Even the term 'Royal Purple' signifies the importance and wealth of the cloth as a status object. The crushing of thousands of marine gastropods of the species *Murex* was required to dye fabric a deep shade of purple. The work was intensive and unpleasant, from the gathering of the creatures, to the dye extraction from each individual, and the concoction of the dye itself. Since the Roman times, other sources of purple have been used to dye cloth, and the techniques and recipes of *Murex* dye have been lost. Ancient authors, such as Pliny, superficially discuss the dye-making procedure but do not offer details. In the summer of 2001, with generous funding from the Institute of Aegean Prehistory, the author set out to reconstruct *Murex* dye manufacturing techniques. The work was performed in Crete at the site of Kommos, where excavations of the MM II/III period have produced industrial remains of a *Murex* dyeing installation. Crushed *Murex* has also been found in contemporary levels at Palaikastro and Knossos, also on the island. This paper will illustrate the baiting, extracting, concocting, and dyeing experiments. Swatches of linen, wool, and silk will be presented to show color ranges in comparison with ancient iconographic representations of the Royal Purple.

**Keywords:** dye production, *Murex*, purple, blue, marine remains

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## RUSCILLO, D.

### *Using the Mean Shape Method and the Table Test for sexing common zooarchaeological mammals*

**Session:** Ageing and Sexing

**Abstract:** The Mean Shape Method was established by the presenter in 1999 for sexing mammal bones through morphological analysis. Using Eigenshape Analysis, samples of known-sex sheep and deer specimens were examined from 27 different collections in the UK, Canada, and Greece. Eigenshape Analysis is an outline-based method for comparing comparable morphological shapes. By digitizing section outlines of major skeletal elements, X/Y coordinates are plotted around each outline from each bone specimen. These coordinates are then in turn compared to the location of the coordinates of every specimen in each bone group. In this manner, similarities and differences in outline can be pin-pointed and shape patterns can

be plotted. In applicable bones showing sexual dimorphism, males and females, and even castrates can form three clear shape groups clear by plotting hypothetical mean shapes. These mean shapes can then be compared to archaeological bone outlines to suggest sex identification. The Table Test has been developed for sex determination for canids only. The complete adult humerus of a fox, dog or wolf is placed on a level surface and, based on the development of the deltoid tuberosity, will fall over or remain steady on its dorsoventral side. T-tests and contingency table reveal that this method can identify male dogs 85% of the time, and male fox 76% of the time based on a sample of 128 canids. This presentation will show results as well as practical methods that can easily be used in the field.

**Keywords:** sexual dimorphism, sex determination, sex morphology, morphometrics

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## RUSSELL, N., ANTHONY, D., BROWN, E., GOODMAN, A., KOSINTSEV, P. & PIKE-TAY, A.

### *A Bronze Age Dog Sacrifice in the Russian Steppes*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Remains of a previously unknown dog-sacrifice ritual were discovered at the settlement site of Krasno Samarskoe (KS), excavated in 1999 and 2001 as a part of the Samara Valley Project. The project was designed to investigate the Late Bronze Age subsistence economy of the Srubnaya, or Timber-Grave culture, dated here to about 1750 cal BC. Excavations at the KS site, a riverine floodplain settlement, exposed a single large structure, about 8X12m. The floor of the structure, dug about 40 cm into the Bronze Age surface, contained numerous postholes, shallow pits, and two very deep features interpreted as wells, one of which contained waterlogged wooden artifacts and animal bones. The structure is interpreted as a multi-purpose outbuilding at the edge of a larger settlement. It contained discarded animal bones, traces of copper slag and ore, serrated shells used to impress decorations on ceramic pots, chipped and ground stone tools, two whole ceramic vessels set in depressions in the floor, and many ceramic sherds. The most surprising and unique aspect of the animal bones was that 40% of them were from dogs. No Srubnaya settlement, of hundreds excavated, has yielded more than 2% dog bones. The KS dogs were chopped into small, highly standardized pieces with precise blows from an axe, a butchering pattern contrasting with that used on the cattle and sheep. Initial incremental banding evidence suggests that the dogs were butchered in winter, unlike the cattle and sheep, which represent a year-round occupation. A winter-season dog sacrifice could be connected with Indo-European myths preserved in the Roman Lupercalia, the Germanic 12 Days of Christmas, and references in the Rig Veda to Dog Priests who sacrificed to the sun at the winter solstice.

**Keywords:** dogs; ritual; Russia; seasonality; Eurasia

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## **RYAN, K.**

*Cattle Ecology: Herd Reproduction, and the Production of Milk*

**Session:** Milk, Milking and Dairying

**Abstract:** Understanding the biology and instinctual behaviour of one's herd animals is important to successful animal management systems. Exploiting an animal's natural behaviour, or overriding others, for human benefit must have been a prime concern among early livestock keepers. This paper addresses two aspects of cattle management: herd reproduction, and the production of milk, drawing examples first from East African traditional herding groups, followed by comparisons with contemporary, historical, and archaeological examples from around the world.

**Keywords:** cattle, herd management, milking, Africa

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## **SABIN, R.**

*From the Neanderthals to the Normans: the research value of marine mammal remains in the archaeological record.*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** The identification, analysis and interpretation of marine mammal remains from archaeological contexts have

become increasingly important to researchers in recent years. This presentation will examine the contribution of such remains to the analysis of a number of very different archaeological sites, from Neanderthal caves in Gibraltar, to early Norman settlements in the south east of England, and will explore the value of interdisciplinary collaboration. The presence of marine mammal remains in archaeological deposits may be an important indicator of either seasonal hunting practices or opportunistic human exploitation of stranded carcasses. The identification of such material may help to broaden our understanding of the subsistence strategies of past coastal human populations. Equally important is the understanding of the spatial and temporal population dynamics of marine mammals that can be obtained from the analysis of archaeozoological material. The importance of interdisciplinary collaboration cannot be overstated. The expertise gained by zoologists and marine biologists through the study of modern marine mammal species is as important to archaeologists as the recovery and identification of marine mammal remains from archaeological sites are to the understanding of changes in marine mammal population dynamics through time. The use of modern museum marine mammal reference collections by archaeologists, particularly in the UK, is to be encouraged. Specimens collected from around the United Kingdom over a 100-year period by the Natural History Museum (NHM), London, form the basis of a valuable reference tool for researchers. Data gathered by the NHM over the same period relating to cetacean strandings, provides a detailed insight into the biology, ecology, behaviour and causes of death of these animals, data which are of great use to archaeologists seeking to do more than simply identify the cetacean species present in a particular faunal assemblage.

**Keywords:** Marine, mammals, identification, museum, interdisciplinary

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## **SADLER, P.**

**Poster:** *When size is not enough*

**Session:** General

**Abstract:** Measurements normally taken on astragali and distal tibiae were found to be inadequate in distinguishing small cattle from large red deer. Whilst many astragali were obviously from one species or the other, a worrying number were being recorded as, 'Possibly cattle, but with some red deer features'. The distal tibiae also covered a range from obviously red deer to obviously cattle, but there were intermediate specimens. It is hoped the new measurements will help by utilising the differences in shape of these bones rather than relying on differences in size.

**Keywords:** Cattle red deer measurements astragalus distal tibia



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## SAILLOT, I.

*Archaeozoology as a window on palaeolithic cognition*

**Session:** Neanderthal ecology

**Abstract:** The functional processing chain of large mammals acquired in the Mousterian and Magdalenian levels of Tournal cave, Bize (France) are analysed. Paleoethnological results are examined using a method adapted from experimental psychology (the study of goal-oriented activities). The objects used by prehistoric man and their properties are the elements of analysis. Objects and properties are linked by binary relationships. These relationships are processed using software developed at the Institut de Paléontologie Humaine, named SIMBOL, based on an algorithm initially published by the Laboratoire de Psychologie Expérimentale, University of Paris 8. SIMBOL returns a cognitive graph of task representations for the Mousterian and the Magdalenian layers, allowing a rigorous comparison of the cognitive activities of both periods. Results indicate that the logical structure employed is preserved when passing from one level to the other. This could be interpreted as a clue to the noticeable cognitive similarity of humans from the two periods. Cognitive complexity seems to be the same on both graphs. Cognitive fluidity improves during the Magdalenian, relative to the Mousterian, suggesting that cognitive mechanisms such as sense sliding and analogy could have been more developed at the Magdalenian level. Could we interpret this result as a clue to greater creativity in the Magdalenian level? Further investigations are needed to confirm this, as well as enhanced data volume.

**Keywords:** Neanderthal, Middle Palaeolithic, cognitive abilities, SIMBOL, functional processing

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## SAINT-GERMAIN, C.

*Fat today, Fat Always: Animal Fat in the Cultural World of the Native People of Northeastern America.*

**Session:** Animal Fats and Oils

**Abstract:** The importance of animal fats in the diet and in the cultural world of the Native people of Northeastern America will be discussed in this paper. The conclusions of an experiment I conducted on the preparation of bone grease were very conclusive regarding the value of fat for Native people: the only nutritional value of that very demanding activity was the grease extracted from the bones. The search for fat takes many faces: hunting strategies, processing of food, preservation

techniques. The habit of preparing bone grease is culturally encoded by these societies so it can be perpetuated. Fat is omnipresent in their lives and it holds an importance that goes far beyond the physiological benefits it procures to the body.

**Keywords:** Bone grease, animal fats, fat acquisition strategies, cultural food, Northeastern America.

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## SASSON, A.

**Poster:** *Faunal Remains from Stratum II (8th century B.C.E.) in Tel Beer-Sheba, Israel*

**Session:** General

**Abstract:** Tel Beer-Sheba is located on the northern margin of the Negev desert. Stratum II, which dates to the end of the 8th century B.C.E., is the main Iron Age stratum on site. In stratum II, of which two thirds were excavated, Beer-Sheba was a planned city extending over 11,500 sq. m. containing 75 houses, streets, storage rooms and a city wall. Over 10,000 bones (fragmented and complete) were examined. 40% of the bones were identified to body part and species and 60% to body size category. Over 10 species were identified. Sheep/goat (*Ovis/Capra*) and cattle (*Bos taurus*) account 97.5% of the assemblage according to the NISP count. Other species identified are: camels (*Camelus dromedarius*), donkeys (*Equus asinus*), gazelles (*Gazella gazella*), fish (Teleostei) and birds (several species not yet identified). The caprine/cattle bones ratio is 85/15 according to three different counting methods: NISP, MNI and RF. Cattle are probably overrepresented due to the density and the size of the bones in comparison with caprine bones. The medium/large mammals ratio is 95/5 (n= 5897/298) and can also point on bias towards the cattle bones. The sheep/goat bone ratio, according to all diagnostic skeletal elements (n=1000) is 56/44. Similar results (ratio of 51 / 49) were obtained by using the minimalist method (metapodials only, n=90). The reliability of the maximalist method is therefore clear due to the larger sample. The kill-off pattern in caprine points on preference of meat production. According to the teeth examination (n=218) 81% died at ages greater than 12 months and according to fusion of bones (n=857) 44% died at ages of 18-42 months. Other aspects that were examined are: taphonomic factors, the influence of sample size on the frequency of species and bone spatial distribution at the site.

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## SASSON, A.

*The pastoral component in the economy of pre-modern villages, according to ethnographic data*

**Session:** Integrating Zooarchaeology

**Abstract:** In the early 1940s the British Mandatory Government in Palestine carried out a detailed census. At that time, modernism had not yet influenced agricultural practices in many of the villages that were surveyed. The census provides data on the size of population, the size of built and cultivated areas, the size of the flocks held there and their distribution by species, sex and age. This ethnographic data has been used in order to understand better the role of animals in the subsistence economy of ancient sites. In this research project, ancient sites and pre-modern villages located in four different geographic regions in the Central Hill Country of Israel have been examined:

- a) The western foothills, which are climatically humid (ca. 500 mm rainfall annually) and contain agricultural lands
- b) The eastern slopes, which are drier than the other regions (less than 400mm rainfall)
- c) The western slopes, which are humid
- d) The inner valleys in the northern mountain ridge, which are also humid.

The pastoral component in the economy was measured by nutritional parameters (meat, milk, fat, protein) and the conclusions drawn are as follows:

1. In the eastern slopes the pastoral component is the strongest and matches the distribution of lands: 78% of pasture land, 15% of cereal land and only 7% of horticultural land.
2. In the western foothills and the inner valleys, the economy is based on animal husbandry combined with cereal agriculture and horticulture.
3. In the western slopes, the pastoral component is comparatively low and this applies also to cereals. Apparently, the economy was based primary on horticulture (holding 25% of the lands).

The importance of ethnographic data is therefore clearly demonstrated, especially when it is detailed and can be measured statistically.

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**SATHE, V.**

*Taxonomic and functional interpretations of enamel ultrastructure in cattle and buffalo*

**Session:** General

**Abstract:** Precise identification of animals from archaeological context carries important implications for palaeoenvironments, patterns of faunal exploitation for subsistence, socio-religious practices, seasonal occupations of the site and cultural contacts between ancient human populations. Owing to various taphonomic factors involved in the formation of the faunal record often the bones are incomplete and thus assemblage largely remains unidentifiable. This is further complicated with regard to the bones of closely related taxa such as cattle and buffalo, which can not be successfully discriminated especially when the diagnostic features are absent. Against this

background, this presentation will address the analysis of tooth enamel ultrastructure of living cattle (*Bos indicus*) and buffaloes (*Bubalus bubalis*). The study highlights the taxonomic and functional implications of ultrastructural data coming from deep, intermediate and superficial enamel. The complex microstructural configuration of apatite matter in their enamel amply suggests adaptation against abrasive forces during mastication. Qualitative and quantitative assessment of ultrastructural data suggest that enamel ultrastructure can be a meaningful method to discriminate between fragmentary dental remains of these closely related genera.

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**SCHAFFER, C.**

**Poster:** *Ceremonial Significance and Economic Exploitation of the Hawksbill Sea Turtle (*Eretmochelys imbricata*) in Southwest Florida.*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** As with many coastal groups, Southwest Florida's Calusa exploited many varieties of turtles as a food source, with sea turtles representing a major portion. Raw materials for ornamentation and tools were represented by shells, bones, and scutes, a byproduct of these subsistence activities. Unlike other marine chelonians, the hawksbill sea turtle (*Eretmochelys imbricata*) appears to have been utilized exclusively for this purpose, rather than food as they have a spongiverous diet often rendering their flesh toxic. Non-palatable meat, coupled with the beach processing documented in early ethnographic material relative to Central and South America, may account for the limited number of isolated midden finds. Tortoiseshell, derived from *Eretmochelys* scute material, is found, not only in the closest hawksbill habitat, the Calusa region, but also in the greater Mississippi River valley drainage. The presence of *Eretmochelys* objects in these Adena, Hopewell, and Mississippian sites suggests a sizeable Calusa tortoiseshell industry. This material is often associated with ritual forms, generally in mortuary contexts. Hawksbill effigies are additionally represented in organic mediums such as wood, which is generally not preserved. Several such examples known from Cushing's 1890's Key Marco expeditions include paired masks and a figurehead. Among the wealth of preserved organic material recovered from Key Marco are multiple figures, masks and effigies with the pupils of the eyes made of tortoiseshell. Fontaneda's 1573 account details the Calusa belief that one of their three souls resided in their pupils and additionally, that the burial sites were guarded by the "effigies of turtles and other animals functioning to appease the dead." Also significant is the occurrence of tortoiseshell items of Calusa design far from southwest Florida. The cultural context of the hawksbill was clearly focused on the significance of the animal itself with ritual and economic importance supported by archaeological and ethnohistoric evidence.

**Keywords:** Chelonian Zooarchaeology, Chelonian Ethnozoology, *Eretmochelys imbricata*, Tortoiseshell trade, Turtle Effigies

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### SCHIBLER, J. & BAUMANN, M.

*How Neolithic hunters can help us understand recent wildlife ecology and how modern wildlife ecology help us understand Neolithic hunters - the case of Alpine chamois (*Rupicapra rupicapra*) in Switzerland.*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Alpine chamois in Switzerland were at the brink of extinction during the 18th century. Due to appropriate wildlife management during the 19th century, this fate could be turned into a story of success: Alpine chamois nowadays are not considered vulnerable anymore. During the process of population recovery, chamois began to colonize steep forested areas within and outside the Alps. But in forested habitat chamois were soon blamed to alter the vegetation community due to browsing on forest rejuvenation. Chamois were generally assumed to be naturally bound to regions around the Alpine tree line and habitat selection in forested areas was considered as nonnatural, and only possible within the context of the cultural landscape (e.g. missing large carnivores, extensive forest fragmentation). In this situation a problem of conservation priority arose - chamois versus forests. To answer this seemingly unanswerable problem, we combine data from wildlife ecology with archaeozoological data in an interdisciplinary approach. Within a GIS we first build a hypothetical landscape-model of Neolithic chamois habitat suitability (deduced after empirical data of chamois habitat selection). Second we validate this model with archaeozoological data from Neolithic settlements within a generalized linear model, under the assumption, that settlements close to suitable chamois habitat should contain chamois bones and vice versa. Our results explain almost 80% of the observed presence/absence pattern of chamois bones, i.e. the closer the settlement to our habitat model, the more likely it will contain chamois bones. Thus, the hypothetical landscape model performs reasonably well in explaining the natural distribution of chamois within the pristine forest landscape of Switzerland. Chamois therefore re-colonized formerly lost habitat during the 19th century and forests must be regarded as natural chamois habitat, as long as they are reasonably steep. Moreover, the resulting function let us assume, that Neolithic men hunted as central place foragers and restricted their main hunting activity to a radius of 10 km to maximally 15 km. The assumptions behind our methods and the implications of the results for wildlife conservation and in understanding Neolithic forage economy will be discussed.

**Keywords:** chamois, habitat selection, native landscape distribution model, neolithic hunting strategy, Switzerland

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### SCHLUMBAUM, A. & SCHIBLER, J.

**Poster:** *Ancient DNA and the changes in cattle size: an example from the Celtic and Roman period in Switzerland*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** The increase in cattle (*Bos taurus*) size starting with the Roman occupation in Europe and the subsequent decrease after the Roman withdrawal is a well documented observation in archaeozoology. But the reasons are unclear. Changes in size can be due either to husbandry e.g. fodder and health, or to the genetic potential of the animals. Genetic reasons may involve the introduction of bigger cattle from the Roman motherland and/or different breeding strategies also applied to indigenous cattle. Morphometric archaeozoological studies are unable to discern between differences due to husbandry or to genetics. However the analysis of aDNA is a potentially powerful tool to contribute to this debate. We are interested e.g. to investigate the increase of cattle size at the Celtic/Roman transition using bone samples from the Celtic settlements at Basel and from the closely situated Roman site Augusta Raurica, Switzerland, by means of aDNA analysis. The main strategies are i) to establish the presence of authentic DNA, ii) to investigate the female lineages using mitochondrial (mt) DNA, iii) to explore population structures at higher resolution using microsatellite analysis. Initially the PCR amplification of the variable mtDNA d-Loop region was successfully carried out in ca. 70% of the bone extracts and different haplotypes were identified.

**Keywords:** Cattle, Celtic Period, Roman period, Switzerland, Mt DNA.

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### SCHMITT, D.N., LUPO, K.D. & MADSEN, D.B.

*The Worst of Times, The Best of Times: Jackrabbit Hunting by Middle Holocene Human Foragers in the Bonneville Basin*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** A number of paleoenvironmental and archaeological records from the northern Bonneville Basin, western U.S.A. indicate that Middle Holocene desertification began about 8300 radiocarbon years B.P. and persisted over the next several thousand years. A major aspect of this environmental shift in valley bottoms was the abrupt change from dense sagebrush and grassland habitats to more open xeric scrub communities. This change in vegetation prompted an overall decline in mammalian taxonomic diversity, marked population declines in small mammals adapted to cool and moist environs containing sagebrush and annual grasses, and increases in species well-adapted to open, low desert habitats, especially black-tailed jackrabbits (*Lepus californicus*). Using jackrabbit abundances from regional archaeological cave sites in concert with small mammal ecology and human foraging models, we propose that: 1) as the environment got "worse," the opportunity for taking jackrabbits en masse actually got better, and; 2) human foragers became more efficient hunters after this dramatic environmental shift than they were in the more favorable period preceding it.

**Keywords:** jackrabbits, paleoenvironments, human subsistence, Foraging Theory, Middle Holocene

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## SCHREIBER, A. & ZIMMERMANN, W.

**Poster:** *Reproductive seasonality in hemiones, Equus hemionus: a taxonomic criterium?*

**Session:** Equids in Time and Space

**Abstract:** The mosaic evolution of taxonomic characters (V. Eisenmann, loc. mult.) does not only complicate the systematics and phylogeny of *Equus*, but also the recognition of the management units in species conservation. In particular, the management of the nominal subspecies *Equus hemionus onager* from Iran and *E. h. kulan* from Turkmenia as two separate studbook populations in zoological gardens is controversial. These geographical stocks are distinguished by somewhat subtle differences of body height and craniometry, and by distance measures of RAPD-DNA, but not of allozymes or single-locus DNA (Schreiber et al., 2000). Different foaling seasons in captivity, with birth peaks in May (kulans) or June (onagers) have been reported (C. Pohle, Zool. Gart. 42, 1972). If heritable, this difference could reflect the adaptation of two equid populations to survival in semideserts, and prove relevant for defining the breeding herds. The reproductive seasonality of equids is known to depend on certain ecological factors, but the heritability of circumannual rhythms, if any, remains poorly

understood. Comparing 1026 hemione foals from 37 European zoos revealed a significantly (U-test;  $p < 0.0001$ ) earlier foaling date of 305 onagers (median: 23rd June 23) than of 721 kulans (median: 3rd June). The geographical location of the breeding institutions in an east-west gradient in Eurasia (22.3%) explained a greater proportion of the total variance (MANOVA) than did the subspecific identity (1.38%). The birth season of kulans, but not of onagers, correlated with the geographical location of zoos between 0°E and 12°E geographical longitude ( $r = -0.24$ ;  $p < 0.0001$ ), but only if the kulan sample included foals from the game park at Askania Nova (Ukraine). The 161 foaling dates from this steppe reserve, but not those from city zoos, followed a Gauss distribution, and a lower standard deviation, and their mean value, May 24th, predated the birth peak, 22nd June, of 560 kulan foals from city zoos significantly ( $p < 0.0001$ ). Accepting the normal distribution at Askania Nova, and its lower variance (s.d. = 12.62 against s.d. = 52.99), as the natural model, suggests to negate all foals ( $n = 176$ ) born in zoos at >50 days from the population mean. Of the variance of this corrected database, 17% is explained by geographical latitude, 14% by the husbandry specificities of individual institutions, and 4.5 % by the identity of being a kulan or an onager (MANOVA). Regression of 167 foaling dates to the parental means produced insignificant heritability estimates. In conclusion the different foaling seasonality of zoo-living onagers and kulans differs by including a large subsample of kulan foals born under seminatural steppe conditions, by unexplained differences of husbandry management in the 37 zoos concerned, and by the location of these zoos in a west-east-gradient of relative climatic continentality. Significant heritability is not obvious, although a minor genetic influence could be concealed by the highly inflated artificial variance of foaling times in zoos. In any case, reproductive seasonality cannot be rated as a taxonomic character to recognize the populations of medium-sized hemiones from southwest Asia.

**Keywords:** *Equus hemionus*, reproductive seasons, heritability, conservation management

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## SCHWARTZ, M

*An Evaluation of the Dog's Role in Non-Mortuary Ritual Among the Classic Mimbres: A Comparative Approach*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The Classic Mimbres were a small-scale agricultural society who lived in southwestern New Mexico from A.D. 900 to A.D. 1100. Because of the representational nature of much of their artwork, many ideas about their secular and sacred activities have been suggested. However, in the substantial

corpus of studies of figurative representations in Mimbres art, dogs as a subject has been virtually ignored. I will argue that certain quadrupeds in the narrative scenes on Mimbres Classic Black-on-White bowls are domestic dogs and that dogs were part of a small suite of animals important in Mimbres ritual life. This proposition, strengthened by archaeological evidence of animal interments at Mimbres sites, is based not only on Mimbres iconography, but, by analogy, on ceremonial activities known to have occurred throughout the Americas. Dogs, because they were reliably available as well as being expendable, were frequently the expedient choice for ceremonial functions.

**Keywords:** Dogs, Mimbres, ritual, art, fauna

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### SCOTT, D.

**Poster:** *Dogs and bones... can living dogs give us clues about the dogs of archaeology?*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Harcourt's seminal paper of 1974 gives his formula for the estimation of the height of a dog (to the shoulder) using the length of limb bones (excluding achondroplastic (dwarf) dogs and those with longer legs than the 'norm'). By looking at living dogs we can see that the shoulder joint is articulated in life at a multiplicity of angles, each angle giving a different height even if the limb bones are the same length. The height of a living dog also depends on the thickness of the pads of the foot, the articulation of the phalanges, and the angle that the metacarpals make with the carpus. One of the reasons for the publication of Harcourt's paper was to improve subjective interpretations of dog size such as 'large', 'medium' or 'terrier sized'. We now need to extend the height range calculated for each skeletal dog to take the soft tissue into consideration.

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### SCOTT, E.M.

*The Role of Dogs in Prehistoric Agricultural Societies of the North American Midwest and Eastern Woodlands*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Much of the zooarchaeological research about dogs in the New World has been conducted for sites in Mesoamerica, the Caribbean, and the Great Plains of North America (e.g., Hamblin 1984; Wing 1991; Snyder 1991). This paper looks at two other regions, the Mississippi Valley and eastern Great Lakes of North America, and at the evidence for the role dogs played in subsistence, social, and symbolic realms. Using data from Late Woodland, Emergent Mississippian, Mississippian,

Oneota, and prehistoric Iroquoian occupations, the paper examines dog remains found in general food refuse contexts; worked dog bones found in possible gender-specific and activity-specific contexts; and dog burials, especially those that appear to be in ritual contexts. Finally, the paper discusses the evidence for dog and human interaction and interdependence in prehistoric agricultural/horticultural societies in these regions.

**Keywords:** dogs, North America, ritual, subsistence

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### SEDLÁÈKOVÁ, L.

**Poster:** *Sexual dimorphism in the postcranial skeleton of European fossil elephants*

**Session:** Ageing and Sexing

**Abstract:** The fossil elephants of two contemporaneous phylogenetic lines were widely distributed in Europe during the late Pliocene and Pleistocene. The mammoth lineage was represented by three main nominal chronospecies: the southern mammoth (*M. [Archidiscodon] meridionalis* [Nesti]), the steppe-elephant (*M. trogontherii* [Pohlig]) and the woolly mammoth (*M. primigenius* [Blumenbach]). The only representative of the second elephant lineage is the forest or straight-tusked elephant (*E. antiquus* [Falconer & Cautley]). Sexing skeletons of fossil elephants is important for understanding aspects like the taphonomy of sites, interpretation of size or social structure. The high degree of accuracy in sex determination for fossil elephant is given by complex features in whole skeleton. The morphology of the skull and tusks is of great value for separating male and female adult animals but most discoveries include separate bones with these elements lacking. In addition to sexual dimorphic characters of the cranial material, the postcranial bones provide information for gender determination, as former studies have shown for some fossil or living elephants. This study was undertaken to establish the diagnostic biometrical and morphological features of the postcranial skeleton of four European fossil elephants for sex determination. This information could also contribute to future works in determining the sex of individuals from separate bones.

**Keywords:** proboscids, fossils, sex determination, elephants, phylogeny

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### SEDLÁÈKOVÁ, L.

**Poster:** *The postcranial skeleton of European fossil elephants*

**Session:** General

**Abstract:** The representatives of the family Elephantidae in Europe created one of the most typical elements of the mammalian fauna during the Pleistocene. They included four species: the southern elephant (*M. [Archidiscodon] meridionalis*), the steppe elephant (*M. trogontherii*), the woolly mammoth (*M. primigenius*) and the forest elephant (*E. [Palaeoloxodon] antiquus*). These species were divided to two contemporaneous lineages of the evolution: the mammoth line, which was adapted to open biotopes, and the elephant line, constituting inhabitants of woodland. The mammoth lineage first appeared with *M. meridionalis*. The most scientists prefer using the genus *Mammuthus*, but some palaeontologists accept still the validity of genus *Archidiscodon*. It should be noted that the comparative morphological analysis of these genera reveals significant differences between both species. The second representative of the mammoth lineage, the steppe-elephant (*M. trogontherii*), has an intermediate position both zoologically and geologically and it represents a real bridge between the southern elephant and the woolly mammoth. The most highly derived condition for the mammoth lineage exhibited by third species of this lineage, *M. primigenius*. The only representative of the second line is the forest elephant *E. antiquus*. Contrary to mammoth line, which is distinguished by progressive adaptation to colder climates during the Pleistocene, the forest elephant shows the conservative features and its remains are suitable rather to using as an ecological indicator. Species determination of elephants usually focus on characters of their skulls, lower jaws and first of all of premolars and molars. Diagnostic features on the morphology of postcranial skeleton is much more difficult. The present study gives results of detailed study of postcranial skeleton of four European species from various European localities. Obtained informations were confronted also with former published results. The knowledge of the exact morphology of the postcranial skeleton of the fossil elephants will allow to easier determine the systematic identification of the remnants of fossil elephants even in the case of lack of teeth or cranial material.

**Keywords:** proboscids, fossils, elephants, phylogeny

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## SEETAH, K.

*Multidisciplinary approach to Romano-British butchery analysis*

**Session:** Integrating Zooarchaeology

**Abstract:** Previous literature has pointed to crude and unskilled practices being used by butchers during the Romano-British period. However, by adopting a multidisciplinary approach to the analysis of butchery marks, it has been shown that the cut

marks are more likely to represent specific techniques that were in fact highly specialised and efficient at expediting carcass dismemberment. The present study used modern butchery practices to replicate a number of the more distinctive marks in order to clarify what actions may have caused them, what implement may have been used and what actual function (i.e. was the cut made for dismemberment, skinning etc.) was evident. In addition to incorporating contemporary butchery and modern knife manufacture practices; information from archaeo-metallurgic reports detailing shape, where artefacts were found and potential uses was also employed. Data from iconographic and literary sources was also used to gain clearer interpretation from the amalgamation of resources. The results allowed for practical as well as cultural conclusions to be drawn. For example it was seen that meat removal at the scapula and femur both employed the chopping action of the cleaver, a technique which appears unique to this period; urban Romano-British butchery marks seem to point more to a need for speed rather than a lack of skill. Furthermore, specific implements were in production and use, and that unlike the modern cleaver, the Romano-British cleaver was in fact a dual-purpose implement designed to facilitate carcass dismemberment. The current study has shown the value of using a multidisciplinary approach to amalgamate information from various strands of archaeology in order to make better use of archaeological material. With further research butchery analysis should elucidate a range of information relating to diet; cuisine; trade; use of space; acculturation; meat production; implement specialisation and status of the butcher.

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## SERJEANTSON, D.

*Sheep husbandry and sheep milking in prehistoric Britain: the zooarchaeological evidence*

**Session:** Milk, Milking and Dairying

**Abstract:** Much debate has been generated on the question of whether cattle were milked in the British Isles in prehistoric times, but up to now no-one has made the case for sheep milking. Researchers in the Mediterranean have argued that the sheep and goat flocks were milked, and individual writers have referred from time to time to the possibility that prehistoric sheep (and goats) were milked in prehistoric Britain, but it has never been discussed in detail. Work on lipids has shown that some prehistoric pottery has held milk or milk products, but has not up to now distinguished between those of cattle and sheep. Here I will summarise the theoretical age structures of sheep flocks managed - with varying degrees of intensity - to produce milk and cheese, and will argue that the age at death seen in prehistoric assemblages from Britain dating from the Middle Bronze Age onwards fits very well with the notion that some flocks were raised quite intensively for milk.

**Keywords:** sheep, goat, milking, Bronze Age, production models.

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### **SERRAND, N. & BONNISSANT, D.**

*The preceramic Orient Bay site's shell remains (Saint-Martin, Northern Lesser Antilles): Consumption and production - preliminary results.*

**Session:** Archaeo-Malacology

**Abstract:** The pre-Columbian preceramic site of Orient Bay, located on the north-eastern seafront of the Caribbean island of St Martin, in the Northern Lesser Antilles, is dated to between 800 and 400 B.C.. The site, of which over 500 square meters were excavated in 2000, revealed several structures associating remains of shellfish cooking and eating and of shell and stone tool making. Two of the excavated areas yielded more than 11 000 shell remains which indicate intensive gathering by the Orient Bay inhabitants of mainly five shell taxa – the Queen Conch *Strombus gigas*, the nerites *Nerita peloronta* and *N. versicolor*, the West Indian topshell *Cittarium pica* and the fuzzy chiton, *Acanthopleura granulata*. Besides shellfish consumption activities, the site documents the exploitation of the lips of older *Strombus gigas* specimens for the production of tools. The data collected during the excavation, the tools' technological study, and the refittings of many Queen Conch's shell fragments indicate that the 'chaîne opératoire' is entirely documented at the site, including remains of the lips' debitage up to finished tools, among which some have been stored and used.

**Keywords:** Pre-Columbian, preceramic, Northern Lesser Antilles, shellfish consumption, shell tools

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### **SERRAND, N. & VIGNE, J.D.**

*Marine shells from the Early preceramic Neolithic of Cyprus at Shillourokambos (9th-8th mill. cal. BC): a mainly ornamental set with similarities to mainland PPNB*

**Session:** Archaeo-Malacology

**Abstract:** The mollusc fauna coming from areas 1, 2 and 4 (1992-2001 excavations) of the Shillourokambos early Preceramic Neolithic site (late 9e, early 8e mill. cal. B.C.), in Cyprus, has been analysed from a zoological, taphonomic and technological point of view. The remains, a total of 256 specimens representing thirty-three gastropod, bivalve and scaphopod species, are few in all of the analysed areas and for each of the defined chrono-stratigraphic phases. Given the shells' conditions and the frequency of human-made modifications, this assemblage essentially shows evidence of gathering of fresh or dead shells (even fossil ones), for use of their raw material. The other remains testify to a minor part of dietary consumption (4% of the remains), to the collection of fresh water gastropods, probably along with building materials, and to likely accidental introductions to the site. The vast majority of the shells (238 remains) were indeed collected battered, often worn or exhibiting natural borings, and used as they were, improved, and, in some cases, transformed. The intentional transformation techniques reveal a low investment and mostly proceeded through rubbing, sawing and percussion leading to the perforation of the shells for hanging. This mollusc material is similar, in its major characteristics, to those of the middle and late PPNB of the Near East and confirms the relationships between the Cypriote ancient Preceramic material cultures and those of the continent.

**Keywords:** Shillourokambos, early preceramic Neolithic, Cyprus, shell ornaments

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### **SIRACUSANO, G.**

**Poster:** *Animal husbandry and centralized culture: how a social and political feature could influence the rural lifestyle.*

**Session:** General

**Abstract:** The poster shows the changes, recognised by the faunal assemblages, that took place from the end of the fourth millennium A.D. onwards, at Zeytinli Bahçe (Urfa, Turkey). In the Urfa/Adiyaman zone, along the middle and upper Euphrates River and in the North of Mesopotamia, pig breeding seems to be a deeply-rooted tradition, since Neolithic time. As a sort of indicator, it markedly decreased in connection with the influence of centralised organisational systems in favour of sheep and goats that became far more common species of the livestock.

**Keywords:** Late Uruk, Early Bronze Age IA, Early Bronze Age IB, Upper/middle Euphrates River, rural lifestyle

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### SIRACUSANO, G.

**Poster:** *Archaeozoo-ecological footprint: How sustainable was the animal breeding?*

**Session:** General

**Abstract:** The poster shows the relationships between basic human needs and the rate of material and energy throughout the Bronze Age taking as a pattern the stratified site of Coppa Nevigata (Southeast Italy). The Study of 20000 faunal remains shows that throughout the Bronze Age the households exploited the natural resources breeding domestic animals, hunting, fishing and gathering. The importance of each species that the studies on the bones pointed out, was linked with the meat diet and the needs of the population. If we assume a steady state economy (that means a constant human, harvest and livestock load), and negligible imports or exports, the people of Coppa Nevigata, according to their technology level and livelihoods, utilised the ecospace to achieve a sustainable development. The amount of livestock had to assure, yearly, the replacement of the eliminated animals, keeping under the threshold of environmental capacity. Animal husbandry and agricultural activity could define the ecological footprint. If the land functionally required to support the community exceeded the carrying capacity of the environment, it could be an evidence of transhumance.

**Keywords:** megajoule, sustainable development, carrying capacity, steady state economy, ecospace, ecological footprint

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### SMITH, I.W.G.

*Retreat and Resilience: fur seals and human settlement in New Zealand*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Anthropogenic depletion of New Zealand's avifauna has been widely cited in discussions of the impacts of human colonisation on island environments, but much less attention has been paid to effects upon marine resources. This paper reviews evidence for the nature and consequences of predation upon the most abundant marine mammal, the New Zealand fur seal *Arctocephalus forsteri*. Two major phases of exploitation are apparent, involving widespread but low intensity cropping for food in the early prehistoric period, and a more localised but higher intensity take for skins in the early historic period. The rapidity and extent of impacts upon fur seal populations during each exploitative phase are identified, and post-exploitation population changes reviewed. Some general conclusions are

drawn about human impacts on marine resources during island colonisation.

**Keywords:** Fur seals, New Zealand, human impacts, island colonisation.

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### SMITH, L.

*Living on the Edge: Marine Mammal Exploitation Strategies at Adamagan, a mid-Holocene Aleut Village on the Lower Alaska Peninsula*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** Located on the edge of the modern day lower Alaska Peninsula, the prehistoric inhabitants of Adamagan (XCB-105) had access to a wide variety of marine resources from both the North Pacific Ocean and Bering Sea. Due to the rich shellfish middens preserved at the site, the archaeofaunal assemblage provides a detailed view of Aleut marine mammal exploitation during the mid-Holocene. Remains of whale, pinniped, porpoise and sea otter paint a picture of a complex maritime adapted society. Hunting tools, both lithic and organic, are well represented at Adamagan, and provide clues about Aleut marine mammal procurement strategies. This paper will examine marine mammal exploitation and procurement strategies at Adamagan, as well as examining the site in relations to its regional and temporal setting.

**Keywords:** Sea mammals, Adamagan, Alaska, Bering Sea, North Pacific Ocean

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### SNYDER, L.M.

*Dogs in the ritual life of Athens: deposits from one Late Archaic and one Late Hellenistic well in the Agora.*

**Session:** General

**Abstract:** Two wells in the Athenian Agora, one Late Archaic, one Late Hellenistic, present very different pictures of the meaning of dogs in the lives of the people of Athens. The first, excavated in 1937/38, lies on a gentle slope below the Hephaisteion, in an area of houses and metal workshops and away from the public and ceremonial areas of the Agora. Its final filling dates to ca. 175-150 BCE, by which time the area had largely been abandoned. Six meters of the deposit in this well produced the remains of 450 human infants, and over 150



domestic dogs. Although commingled when excavated, it appears that both infants and dogs entered the well as complete, articulated individuals. With only a handful of exceptions, the infants were full term or neonatal in age. In contrast, the dogs range in age from fetal to aged, and a variety of body sizes and morphological types are indicated. The second well, located near the 5th century altar of Aphrodite and excavated in 1994/95, was closed by a single, massive and choking fill soon after the Persian destruction of Athens in 479BCE. Near the top of this deposit the remains of eight adult dogs, all heavily butchered, were recovered. The infants and dogs deposited in the Hellenistic well suggest a ritual or chthonic association, perhaps involving purification after childbirth, or supplication to an entity such as Hecate. In the Late Archaic well, the meaning of the butchered dogs is more difficult to interpret. There is little textual evidence to suggest that actual meals of dog meat were a part of a known ritual, certainly not in the amount represented by eight adult animals, and the identity of the individuals responsible for this deposit, Athenian or Persian, is open to question.

**Keywords:** Hellenistic Athens; Archaic Athens, Dog sacrifice; Consumption of dog meat; Chthonic ritual

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#### **SPINETTI, A. & MARRAZZO, D.**

**Poster:** *Osteological analysis of faunal remains from the medieval tanneries of Priàmar (Savona-Italy)*

**Session:** General

**Abstract:** During the digs of the medieval tanneries of Savona (North western coast of Italy), 11,797 animal bones were collected and 3,533 identified. The tanneries, dating from the 13th to the 15th century, were located within the Contrada of S.Domenico, a suburban, water rich area which included the Dominican Convent, the surrounding houses and the commercial and artisans' district located at the foot of the Priàmar's Fortress. The main purpose of this preliminary study has been the identification and interpretation of tanning activities on the site separating kitchen and slaughtering refuse from tannery's waste. Most of the faunal remains were recovered in the tannery courtyard (2,565 bones and 6,000 fragments). Data were collected on species, skeletal parts, age of slaughter, sex, method of butchery and evidence of bone working. It has been possible to identify the three major domestic meat producing animals: cattle, sheep, goats, pigs and some wild species such as red deer, hares and a sturgeon. Several features of the tannery courtyard contained specialized assemblages of bones which are likely to be connected with tanning activities: in fact, an emphasis on cattle bones occurred in Phase 4 and 5 (13th-15th century) with a large amount of horns, phalanges and tails. In most of these deposits it was clear that cattle horn cores had been removed along with the top part of the skull by cuts made by a cleaver or hatchet. Through different documentary and anecdotal evidences

it has been possible to assert that these bones were deliberately left on the skin and it seemed reasonable to think of a specialized heavy cattle tanning.

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#### **STALLIBRASS, S.**

*Archaeology, art, religion and dead fish*

**Session:** Integrating Zooarchaeology

**Abstract:** Rescue excavations at a medieval religious site in Britain produced some worked fish and mammal bones. The stratigraphic context of these worked bones suggests that they had been deposited in groups in specially chosen locations. Evidence is drawn from a variety of sources to suggest that these worked bones were buried as religious paraphernalia in sacred contexts. These sources include historical references to medieval Christian beliefs in Britain, architectural styles, medieval religious art and iconography and analyses of archaeological artefacts. The fish bones also provide 'economic' evidence for environmental exploitation, and for methods of food procurement, preparation, preservation and trade. The importance of this study is that it demonstrates that our modern concepts that separate work, economics, daily subsistence and religious beliefs are irrelevant schisms. In the past, a group of fish bones could represent a live animal caught in a leaky boat in a dangerous sea, a smelly dead animal that needed gutting and salting, supper, something to trade, raw material for manufacturing artefacts, and a means of communicating with a god. Why should any one of these be any more important than the others, when they are all so intricately linked?

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#### **STALLIBRASS, H.B., TIGG, A., WOODING, J., BOND, J. & McDONNELL, G.**

**Poster:** *The cutting edge: the significance of butchery marks.*

**Session:** General

**Abstract:** This poster presentation aims to point out some of the uses and advantages of studying butchery marks on animal bone in an integrated approach with both lithic and archaeometallurgical studies to gain further insight into the technological and economic aspects of a site. Butchery marks on

animal bone from sites located in the Northern Isles have been used as a case study to look at the development of butchery technology over time from the Neolithic through to the Norse Period. Butchery marks often provide the only indicator of the tools used, as metal tools do not often survive. The assemblages from the Northern Isles have been compared with experimental data and archaeological examples from York, where exceptional preservation conditions mean that a large metal tool assemblage has survived as well. This research shows that butchery marks provide invaluable and unique data, giving otherwise inaccessible information about a settlement's lithic and metallurgical resources. This data can be mapped to show chronological technological change and the relationship with cultural and economic factors, adding a broader dimension to the understanding of a settlement. (This work is partially funded by The Arts and Humanities Research Board.)

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### STANC, S. & BEJENARU, L

*Animal Offerings Found in Tombs Belonging to Santana de Mures-Cerniahov Culture (IV-V Centuries), In the East and South Extra-Carpathian Zones of Romania.*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** Our study is based on data obtained by us as a result of the analyses of the zooarchaeological samples extracted from Miorcani (in the east of the country), as well as data in the literature for other twelve burial places (seven from the east and five from the south). Animal offerings in tombs were made in accordance with the belief in a future life. Our paper discusses the frequency of the burial rite (inhumation and cremation) and the types and characteristics of the animal offerings found in the inhumation tombs. Under the appellation "animal offering" we have included both offerings of meat, and of objects of animal origine (body ornaments – bone beads, canines, gastropode shells, large rings of buck horns, and objects of everyday use – combs and tubes of bone in which needles were kept). Of all this objects, combs predominated. They were made of buck horns and they are characteristic for this culture. In connection with offering of meat we have found out that:

- the bone remains which were identified come from both domestic, most of them, and wild animals;
- most offerings consisted in a single species, but there were also double and triple offerings;
- the preferred species is the sheep, especially the young ones (below one year of age);
- the offering consisted, most often, of heads and of the extremities of the four legs.

In most of the cases the meat offerings were accompanied by reach archeological inventory. Not all tombs contain animal offerings. For the time being, no correlation could be made between the type and the quantity of the animal offering and the characteristic of the deceased (sex and age).

**Keywords:** Romaina, Cernoahov, Santana of Mure, animal offerings, cremation

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### STEELE, T.

*Accuracy of age determinations from tooth crown heights: a test using an expanded sample of known age Cervus elaphus.*

**Session:** Ageing and Sexing

**Abstract:** Archaeologists have discussed the utility of the Quadratic Crown Height Method (QCHM) for estimating animal age-at-death from hypsodont ungulate teeth. Klein and colleagues pioneered much of this work using a sample of Cervus elaphus with known ages. I expanded this sample to include a total of 226 C. elaphus with known ages from the same population of Rocky Mountain elk in western Montana. There is no difference in rates of wear between males and females, so the sample can be analyzed in its entirety. This expanded sample increases the number of older individuals, allowing further investigation into the relationship between crown height and age in hypsodont ungulates. Regression of age on tooth crown height shows that there is a strong relationship between crown height and age, and regression equations can satisfactorily estimate age from crown height in specimens from the population that provided the known-age individuals. The QCHM, however, does not adequately estimate age for all teeth. Therefore, I adjusted the formulas, primarily the age at which the tooth crown height reaches '0', to increase the accuracy of the age estimations. I also make additional adjustments and provide revised formulas. Finally, I compare the relationship between tooth crown height and age in C. elaphus to the relationship found in known age samples of Odocoileus virginianus and Rangifer tarandus.

**Keywords:** Age determination, Quadratic Crown Height Method, tooth crown height, known age ungulates, Cervus elaphus, Odocoileus virginianus, Rangifer tarandus

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### STEELE, T.

*Variation in the age at death of red deer in Late Pleistocene archaeological assemblages from Western Europe*

**Session:** Neanderthal ecology

**Abstract:** Prey age-at-death is often used to assess hunting strategies, but the ages of animals represented in Middle

Palaeolithic ungulate assemblages vary widely through time and space. Explaining this diversity is crucial for reconstructing human behavioural evolution. To address this issue, I studied one species, red deer (*Cervus elaphus*), from multiple Middle Paleolithic assemblages from France and northern Spain. I reconstructed age distributions using three methods: histograms, boxplots of median crown heights and modified triangular plots, and two tooth combinations: dp4/p4 and dp4/m1. Two samples served as comparative baselines: a sample of *C. elaphus* killed by modern hunters in western Montana and a sample of *C. elaphus* hunted by wolves reintroduced into Yellowstone National Park, Wyoming. The mortality distributions of these two samples differ dramatically. The wolf kill sample contains more juvenile and old individuals, while the hunter kill sample has more young adults. I compared Middle Palaeolithic samples to Upper Palaeolithic samples from the same region and examined variation with respect to time, stone tool technology, and the environment. My results show that 1) age profiles in Palaeolithic assemblages always have fewer old individuals than the wolf kill profile, 2) more ancient Middle Palaeolithic assemblages tend to contain fewer young adult prey than more recent Middle Paleolithic and all Upper Palaeolithic assemblages, and 3) mortality profiles from some recent Middle Palaeolithic assemblages are indistinguishable from Upper Palaeolithic age distributions. Variation in mortality profiles is not readily explained by any one factor, and even wider sampling is needed to address these issues fully.

**Keywords:** *Cervus elaphus*, mortality profiles, age distributions, subsistence, hunting

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#### STEPHAN, E. & NEUMANN, U.

*Examples of diagenetic alterations of Pleistocene mammal bones*

**Session:** Taphonomy

**Abstract:** Investigations concerning the environments of prehistoric mammal populations are increasingly based on scientific methods e. g. trace elements and isotopic analyses. Using these methods for the investigation of buried bones diagenetic alterations have to be taken into consideration, because of the possible changes both of the histological structures and of the mineralogical (and chemical) composition. Polarizing light microscopy and X-ray diffraction were chosen to investigate the preservation of a selection of Pleistocene bone remains. The equid and reindeer compact bone samples originate from palaeontological and archaeological sites in Germany dated to different periods (Mosbach, Wannan, Geissenklösterle, Vogelherd: approx. 600.000 – 10.000 BP). The X-ray diffraction spectra of most of the investigated bones show slight to medium recrystallizations of the hydroxyapatite, and the microscopy of transverse thin sections prove varying states of preservation of the histological structures. All observed

alterations do not correlate with the age of the bone finds. Some bones contain secondary calcite crystals in all Haversian canals and fissures although the osteon structures are still in good preservation. Equid bones from Mosbach show the most interesting features. Their surfaces are covered with manganese oxides, which invaded into the tissue via fissures and cracks. Additionally, a layer of red coloured osteons near the external circumferential lamellae characterizes all Mosbach samples. These colourings consist of iron hydroxides e. g. limonite. Such structures could be interpreted as boundaries between poor preserved coloured tissue near the periosteal bone surface and well preserved mid-cortex compact bone substance. The investigation with crossed polars, however, proved that all areas are anisotropic and consist of well-preserved Haversian systems, although the bone collagen is almost completely destroyed. The observed birefringence could be explained by an orientated replacement of collagen fibres by recrystallized apatite.

**Keywords:** Bone, Diagenesis, Histology, X-Ray-Diffraction, Pleistocene

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#### STEWART, J.R. & COLLARD, M.

*The Fate of the Neanderthals – a special case or simply part of the broader Late Pleistocene megafaunal extinctions?*

**Session:** Neanderthal ecology

**Abstract:** The extinction of the Neanderthals has not been considered in the light of the palaeoecology of other mammals. Therefore, a palaeoecological and historical biogeographical analysis of a database of European mammalian fossils for the period covering 60 – 20 K calendar years (approximately OIS 3 covering the time when Neanderthals became extinct) has been conducted that shed light on the ecological conditions of this period. Broadly the larger mammals in this database form historical biogeographical categories including extant ubiquitous, extant northern and montane, extant eastern, extinct northern and extinct southern taxa. Neanderthals belong to the extinct southern grouping that highlighted the lack of attention they had received from the perspective of extinct Late Pleistocene Megafaunal elements. The temporal distribution of taxa confirms the decline towards the Late Glacial Maximum of the southern extinct group and further reveals a decrease in the occurrence of many smaller carnivores. The latter may indicate a decrease in carrying capacity as temperatures decreased which is supported by the decrease in mammoths on non-archaeological sites. The geographical distribution of the larger mammals of OIS 3

confirms a retreat towards the South and West of Neanderthals similar to that of the straight-tusked elephant *Elephas antiquus* and Merk's rhino *Stephanorhinus kirchbergensis*, both of which also became extinct towards the Late Glacial Maximum. The change in geographical distribution of the European wild ass *Equus hydruntinus* through OIS 3 may be closest to that of the Neanderthals implying similar tolerances. The results of the palaeoecological and palaeobiogeographical study of Neanderthals prompt a reconsideration of their supposed adaptations.

**Keywords:** Neanderthal, Megafauna, Extinction, Biogeography, Ecology

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### STOPP, B., REHAZEK, A. & BREUER, G.

**Poster:** *Size development of domestic animals between 150 BC and 700 AD in Northern Switzerland*

**Session:** General

**Abstract:** At the end of the late Iron Age and in the first centuries after Christ a remarkable change in the size of domestic animals can be observed. This trend is also visible in the region of northern Switzerland. All domestic animals show an increase in bodysize between the end of the Iron Age and the 3rd century AD which can be explained to some extent by the import of bigger animals but most of all by the overall improvement in animal keeping. At the end of the roman era a contrary evolution sets in and in the early Middle Ages all domestic animals with the exception of the horses end up with the same size they had during the late Iron Age. By comparison with other European countries it is shown that the beginning and the intensity of this development depends on the romanization or at least the degree of roman influence in a certain area.

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### STORÅ, J.

*Man Animal Relations in the Pitted Ware Culture of Neolithic Eastern Middle Sweden.*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The Pitted Ware culture (PWC) represents a hunter-gatherer complex which, c. 3300-1800 BC cal, mainly was distributed along the coastal areas of the southern parts of Sweden and islands of Öland, Gotland and Åland. The complex is contemporary with both the Funnel-Beaker culture and the Battle Axe culture which in this area represent "neolithic" cultures. Differences are, however, not only limited to the subsistence economy. I would like to focus attention on some aspects in the faunal record of the PWC which indicate that the relationship between man and animals was complex and probably not only limited to an economic dimension. Methodologically I am inspired both by the ethnographic record of hunter gatherer cultures and by recent zooarchaeological studies which have advocated approaches with less emphasis on the economic sphere of animal utilization. A common feature in many hunter-gatherer cultures is the ritualized treatment of the remains of prey animals. The ritualistic handling is, however, often an integral part of the "economic" utilization of the animals. This is a challenge for zooarchaeology to find alternative perspectives "beyond calories" for interpretations regarding man animal relations. Deposited bones may carry significant symbolic meaning. I will discuss the contextual circumstances and some specific features of the faunal remains on some PWC sites in the Åland Islands, the island of Gotland and in Eastern Middle Sweden. Some aspects of the Pitted Ware culture seem to be very different from the other contemporary "neolithic" cultures in the same area. Obviously, the latter cultures do not share the same relationship between humans and animals – especially wild animals. I believe that these differences may contribute to an understanding of the neolithization of the area.

**Keywords:** Handling of Prey Animals; Neolithic; The Pitted Ware culture

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### STORÅ, J. & LOUGAS, L.

*Human exploitation and history of seals in the Baltic during late Holocene*

**Session:** Exploitation and Cultural Importance of Marine Mammals

**Abstract:** The main aim of our project is to investigate human exploitation and history of seals during late Holocene in the Baltic. Faunal assemblages, dating to the Bronze Age and Late Iron Age, from the Åland Islands (Finland) as well as Saaremaa (Estonia) have been examined. All assemblages are dominated by bones of domesticated animals but our study has concentrated on the remains of seals which are found in varying amounts on all sites. We have identified bones of four species of seals, grey seal (*Halichoerus grypus*), ringed seal (*Phoca hispida*), harbour seal (*Phoca vitulina*) and harp seal (*Phoca groenlandica*) in the assemblages. In this paper we will mainly discuss two species; the harp seal and the harbour seal. Today the harp seal is not present in the fauna of the Baltic Sea but it seems that the

species had established a permanent population in the Baltic during the Neolithic (approx. 4000-1800 BC cal). The harp seal was extensively hunted by Neolithic hunters but after the Stone Age it appears only sporadically in faunal assemblages. It has been debated whether there was a permanent population of harp seals in the Baltic during the Bronze Age and Iron Age or if the seals were migrants from the Atlantic. Our osteometric data of harp seal bones seem to indicate that during Late Holocene the harp seal was a seasonal visitor in the Baltic. Today the harbour seal is the most common seal in the southern parts of the Baltic Sea. The species is, however, absent in refuse faunas from the Stone Age and the oldest finds seem to come from the Late Bronze Age. We have identified the species in Bronze Age faunas on Saaremaa but not in the Åland Islands. There are some finds of harbour seal also in Late Iron Age contexts on Saaremaa. Apparently, harbour seal was distributed more to the north in the Baltic Sea during the Bronze Age than today. Possibly, this was the case also in the Late Iron Age.

**Keywords:** The Baltic Sea, the Åland Islands, Saaremaa Island, Harbour seal, Harp seal

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## STREET, M.

### *Equids in the Rhineland Magdalenian*

**Session:** Equids in Time and Space

**Abstract:** The paper will examine the role of equids during the Magdalenian (15,500 BC) in the Central German Rhineland, with particular reference to the major settlement sites Gönnersdorf and Andernach-Martinsberg. The main food resource at both sites was the typically small late glacial species of caballine horse. The paper will quantify the equid material recovered from the remains of a number of distinct dwelling structures. At the larger and more complete Gönnersdorf site at least 50 individuals must have been originally present. Evidence for mortality profiles and seasonality will be discussed. Apparently horses were killed at several times of the year. The material was examined for traces of butchery and the spatial patterning of the equid remains potentially provides insight into settlement dynamics. The Rhineland equid material will be put into context with other aspects of the sites and compared with contemporary material from other regions.

**Keywords:** Germany, Magdalenian, Horse, Mortality profiles

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## STUDER, J.

### *Goat for milk, sheep for wool, both for meat? A case study from a Late Bronze Age village in Switzerland*

**Session:** Milk, Milking and Dairying

**Abstract:** The herds exploited by the Late Bronze Age villagers of the dwelling site at Hauterive-Champréveyres is mainly composed of caprids, two third sheep and one third goat. Differences in their relative frequencies, their sex ratio, their pattern of mortality and their bone composition (cortical bone thickness) can be related to divergent purpose of husbandry adopted by the stockbreeders. These choices are also influenced by environmental and social conditions.

**Keywords:** sheep, goat, milking production models, Bronze Age  
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## SYMMONS, R.

### *Bone Density Variation Between Similar Animals and Animals of Different Ages: Implications for Future Taphonomic Analyses*

**Session:** Taphonomy

**Abstract:** Numerous taphonomic processes have the potential to selectively remove animal bones from the archaeological record. This introduces bias into faunal assemblages, which can impact zooarchaeological analyses. Unless this bias is accounted for, there is potential for the misinterpretation of archaeological faunal assemblages. It has long been acknowledged that destructive taphonomic processes are largely mediated by bone density, and relative bone density measurements are frequently used to assess the bias caused by bone destruction. Previous researchers have produced bone density values for a range of animal taxa and skeletal locations. Results are often based on small samples of modern specimens and methods of density measurements are often problematic. Little attention has previously been given to the variation of bone density (and so, susceptibility to destructive taphonomic processes) throughout the life of an animal. This paper introduces a newly developed bone density measurement method based on photodensitometry, which is used to produce density data for 95 well-provenanced modern sheep skeletons. The data produced are used to explore age-related variation in bone density. Results show bone density to be extremely variable between very individuals of similar age, breed, month of death, and post mortem treatment (the method used to deflesh the animals). Such variability has not previously been acknowledged, and has an impact on the way in which density data are used to assess skeletal part distributions in faunal assemblages. Past taphonomic investigations have often relied on statistical analyses, incorporating specific density values. Instead, analyses based on density ranges (reflecting the variability of bone density) are

likely to offer more realistic insights into the effects of taphonomic processes acting on assemblages. Bone density is shown to vary according to the age of an animal in a non-linear manner. Consequently, it is recommended that future taphonomic analyses treat bones from different age categories separately.

**Keywords:** Taphonomy; Bone density; Age; Sheep; Photodensitometry.

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## **SZABO, K.**

*Shellfish and Lapita: Gathering Strategies and their Implications for Subsistence, Settlement Patterns, and Pacific Island Colonisation*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** Shellfish remains are abundant in most Pacific Island archaeological sites, and sites associated with the Lapita Cultural Complex are no exception. The importance of molluscs as a food source, however, has generally been played down with attention being given to agriculture, domesticated animals and fishing. It is proposed here that shellfish were an important protein staple of Lapita diet – more so than fish or domesticates. With the importance of shellfish as a resource being recognized, the intensive fine-grained gathering strategy associated with Lapita shellfish collection has a number of implications for local ecology, and, in turn, settlement patterns. Although there is variation in the scale of human-induced environmental impact between littoral biotopes, it is found that Lapita communities will relocate rather than change gathering or subsistence strategies when shellfish resources are under pressure. In this way, shellfish and their local availability, can be seen as contributing to the speed and pattern of the Lapita settlement of the Western Pacific.

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## **SZABO, K.**

*Shellfish and Lapita: Protein, Intensification and Patterns in Pacific Island Colonisation*

**Session:** Integrating Zooarchaeology

**Abstract:** Shellfish remains are a very visible part of the archaeological landscape of Lapita period sites in the Western Pacific. Although their importance in terms of subsistence strategies is acknowledged, Lapita peoples are typically regarded as having an economy based on tuber agriculture and fishing. This paper seeks to challenge the view that fish were the primary source of protein in Lapita diet, due to both a paucity

of fish bones and lack of technological refinement, and instead forwards that shellfish filled this niche. The viability of shellfish as the major protein source is investigated, and is found to compare well with fish, as well as having additional benefits with regard to important trace elements. This focus on shellfishing rather than fishing, and the generally non-intensified nature of Lapita subsistence, is seen as contributing to both the speed and pattern of Lapita settlement in the Pacific.

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## **TANI, Y.**

*Early techniques as forerunner of milking practices*

**Session:** Milk, Milking and Dairying

**Abstract:** Only the olfactory stimulus or suckling act of the true offspring can induce the milk-ejection reflex in a mother ewe. In order to successfully establish milking, special technical devices are adopted to make use of the stimulus the ewe received from her offspring. Ethnological research into nursing practices amongst Middle Eastern shepherds has recorded several types of devices to assist an orphaned lamb to suckle from a nursing ewe. These nursing devices have parallels to the technical devices used in milking and may be a forerunner to the advent of milking practices. These nursing devices for orphaned lambs are only part of the shepherds' assistance during this nursing period. The shepherd intervenes on a daily basis to avoid possible newborn casualties. These can result from problems in establishing ewe-offspring imprinting after delivery, injuries to the lamb due to overcrowding at the campsites or the failure of the lambs to find their mother at milking time. These unfavourable conditions can be seen as negative effects brought about after the domestication. To prevent the newborn being stamped on shepherds, often keep newborns in a separate, fenced space and daily extend their nursing assistances to them. Archaeological evidence from the later middle period of NNPB has demonstrated the presence of small stone fences inside a large enclosure. This may have served to separate the newborns from the rest of the herd. We may assume that such devices, which are prerequisites for the milking practices, were developed in a rather earlier stage in the Middle East as a device for coping with the negative effects of domestication.

**Keywords:** Ethnographic practises, milking, shepherds, milk ejection reflex

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## **TASSY, M.**

*Variability in Medieval dogs in Hungary*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** While there is a rich ichnographic record of dogs from Medieval Europe, this type of documentation was largely destroyed during the 16th-17th century Turkish occupation and subsequent wars in Hungary. A few masterpieces survive, mostly from beyond the former borders of the Ottoman Empire, often in areas which belong to Slovakia and Romania today. This causes a “taphonomic bias” in the coeval pictorial record. Archaeological excavations in modern day Hungary, however, offer osteological information complementary to this scanty art historical record. Skulls of over a dozen medieval dogs were first metrically analysed, and the results were interpreted by comparing them with 57 modern dog and 13 wolf skulls. Morphometric variability in these medieval dog skulls from Hungary corresponds to that found in medieval art across Central and Western Europe. An attempt was also made to link the physical features of excavated dogs with attitudes to these animals in medieval Hungary.

**Keywords:** Phenotype; dog breeds; iconography; craniometry; attitudes to dogs

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#### TEEGEN, W.-R.

**Poster:** *Rib and vertebral fractures in medieval dogs from Haithabu and Schleswig*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The archaeozoological material from the medieval cities of Haithabu and Schleswig is published extensively. This is also true for dog bones, published in monographs by Wendt (1978) and Spahn (1986). Animal paleopathology is, however, underrepresented. In the present poster, fractures of ribs and the spinous processes of the vertebrae are for the first time recorded. The material consists only of single finds. No complete dog skeleton was preserved. In Haithabu, 5 out of 62 preserved ribs (12%) showed fractures, in Schleswig-Schild 2 out of 42 (ca. 4%) broken ribs were observed. Vertebral fractures were found only in Haithabu in 7 out of 77 vertebrae. Both thoracic and lumbar vertebrae were afflicted. All fractures were well healed. Multiple fractures were never observed. The causes for the fractures will be discussed in the presentation. Incidents as well as maltreatment (cf. Teegen/Wussow 2000) are possible. At least for the vertebral fractures the latter seems more probable. (Acknowledgments: PD Dr. D. Heinrich and H.-J. Frisch (AZA Schleswig-Kiel) made this study possible. Their kind support is gratefully acknowledged.)

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#### TEEGEN, W.R. & DÖHLE, H.-J.

**Poster (and oral presentation):** *Neolithic cattle burials from Central Germany: an archaeozoological and palaeopathological investigation*

**Session:** General

**Abstract:** Three cattle skeletons of the late neolithic globular amphorae culture from Oschersleben (Saxony-Anhalt, Germany) were studied from a palaeopathological point of view. The following diseases were found: dental calculus, hypercementosis, extended parodontitis with tooth pockets and reduction of the alveolar bone, stomatitis (marginalis), dentogenic maxillary sinusitis, extended Sinusitis frontalis, inflammatory meningeal reactions, Otitis media with fistulae into the middle cranial fossa, layers of new built bone at the margin of the alveols and on the long bones, possibly caused by scurvy. Furthermore, degenerative joint diseases are present. The topography of paranasal sinuses, middle ear and cranial cavity is indicating a relationship in the inflammatory processes, possibly through hematogenic dissemination. The fact, that all animals were more or less serious ill, lead to the conclusion, that diseased animals were used for ritual purposes. Other animal burials, however, dating into the iron age, are indicating the same. Possibly, ritual fraud can be assumed. Most of the minor diseases of the skull and the jaws presented here, seem to be quite common in prehistoric animal bones.

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#### TEEGEN, W. & WUSSOW, J.

**Poster:** *The museum of domestic mammals “Julius Kuehn”, Martin-Luther-University, Halle-Wittenburg (Germany), as a source for palaeopathological research”.*

**Session:** Beyond ‘interesting specimens’: palaeopathology and its contribution to the study of animal husbandry

**Keywords:** Palaeopathology, research, museum collections.

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#### **TELLDAHL, Y.**

**Poster:** *Could palaeopathology be used as evidence of animal husbandry? A study of cattle bones from Eketorp Castle, Öland, Sweden*

**Session:** Beyond 'interesting specimens': palaeopathology and its contribution to the study of animal husbandry

**Keywords:** palaeopathology, animal husbandry, cattle, Eketorp Castle, plough

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#### **TELLES ANTUNES, M.**

*The "Zebro" (Equidae) and its extinction in Portugal- a review of the available data. (with an Appendix on the noun "zebro" and the modern "Zebra")*

**Session:** Equids in Time and Space

**Abstract:** This communication deals with the wild ass named "Zebro" or "Zevro", in ancient Portuguese, most probably *Equus hydruntinus*, known there in the fossil status and which became extinct during the Middle Ages. Our research has been based on positive and negative (but useful) evidence from (a) toponyms (the commoner, latin-derived ones and a few toponyms that seem to derive from Arab/ Persian nouns), as well as earliest known toponyms referred to in still earlier (IX to XI century) documents; (b) the "Forais" granted by the earlier Kings of Portugal until the last with "Zebro" references (1277) plus some data concerning usages; (c) hunting documents from the Royal Chancelleries, the last being dated from 1293; (d) the XIIth century "Apocalypse" from Lorvão Monastery; (e) two very important early XVth century books, the "Livro da Montaria" by King João I and the copy of "Chronica Geral de Hespanha" commamded by his son and successor, Prince Duarte; (f) the later "Forais" from King Manuel I (1495-1521) devoid of any references to the "Zebro". Evidence as a whole shows that the "Zebro", although perhaps not represented by large populations, had a broad geographical distribution that comprised the whole territory of extant Portugal. It became more and more scarce since the XIIth century in the North and Northwestern areas owing to growing human pressure in these early reconquered and repopulated regions. The same negative process can be followed afterwards, when the great majority of

new "Forais" do not contain any more references to the concerned animals; among the minority with such references, often only leather is dealt, and not leather plus individuals or meat – hence this seems to point out to scarcity and hunting in rather far away territories. In the second half of XIIIth century, the "Zebro" apparently survived but in Southern and Southeastern Portugal, in recently reconquered and sparsely populated regions that were also more adequate to these preferential open land, steppe-dwellers. There is no more direct evidence from the XIVth century onwards, only rare references in copies of earlier documents. Except for eventual immigration of a few individuals from Southern Spain, where the same species survived until early XVIth century, the "Zebro" was extinct or nearly so in Portugal since the end of the XIIIth century.

**Keywords:** "Zebro" – Portugal, Historical sources - Medieval period – Extinction, *Equus hydruntinus*

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#### **THÉRY-PARISOT, I., COSTAMAGNO S., BEYRIES, S., BRUGAL, J.-P., FOSSE P. & GUILBERT R.**

*Bone Combustible Properties: Experimental and Ethnological Studies.*

**Session:** Animal Fats and Oils

**Abstract:** The use of bone as a fuel source during the Palaeolithic is often cited. We also know historic and ethnographic cases of its use. It is commonly accepted that the use of bone is correlated with wood scarcity, but this hypothesis is only based on the quasi absence of wood charcoal and does not take into account the combustion properties of bone. About 150 experimental examples of the combustion of bone in standardized conditions allowed us to test bone combustion properties and to discuss its advantages and the motivation of its use in Palaeolithic sites. The combustion of bone, which is characterized by the production of a high flame and also by a rapid extinction of the embers, favours two kinds of heat transfer, radiation and convection, but it is completely ineffective for conduction. It is therefore adapted for lightning, drying and direct cooking because it favours convection and radiation, but it is not effective in the transformation of raw material by conduction. Ethnological examples show that bone combustion has several functions depending on groups: fuel, ritual or cleaning. Both ethnological and experimental studies allow us a better understanding of burnt bones in archaeological assemblages.

**Keywords:** Palaeolithic, Bone fuel, Bone combustibles properties, Experimentation, Ethnological studies



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### **THOMAS, R.**

*Of Books and bones: the integration of historical and zooarchaeological evidence in the study of medieval animal husbandry*

**Session:** Integrating Zooarchaeology

**Abstract:** Throughout history the relationship between humans and animals has been a close one. The nature of that relationship has never been static. Even today with the development of cloning and genetic engineering, that relationship is being taken to another level. Arguably, one of the most formative periods in the evolving relationship between humans and animals is that encompassing the 11th to the 18th century. Not only did this period witness the evolution of modern breeds of domestic animals, but it also saw a change in the way animals were perceived and treated. The study of animal bones is an important means of identifying the changing nature of the human-animal relationship in that time. However, it is not the only line of enquiry. Rather obviously, contemporary historical documents also provide a plethora of data regarding the way in which animals were exploited in the medieval and post-medieval periods, and yet these two sources are infrequently integrated. Many animal bone reports have tried to make use of such historical data, however in most cases the documentary evidence only consists of the occasional reference to one of the oft-cited agricultural texts, rather than a full consideration of the wider historical context. Put simply, there has been a tendency for zooarchaeologists to use historical facts as 'interesting anecdotes' rather than as an integral part of the research. Historians are not faultless either, however, and data from published studies of animal reports rarely appears to feature in documentary treatises on agriculture in the period under question. In this paper I will try and offer some explanations to account for the adoption of this 'un-holistic' approach and also try to re-emphasise the importance of using an integrated approach by drawing upon evidence from my own research,

regarding the changing nature of animal exploitation in fourteenth century England.

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### **THOMPSON, M.**

*Medieval dairying in England: prescription, practice and performance*

**Session:** Milk, Milking and Dairying

**Abstract:** Thirteenth-century authors of treatises on husbandry indicated what they believed should be attainable yields of dairy products. These prescriptions (of Walter of Henley whose treatise was written c.1276-90 probably from the standpoint of a manorial bailiff with experience in the West Midlands and Buckinghamshire, and that of the Husbandry, written c.1300 and essentially a treatise on audit practice for monastic use, possibly derived from experience on the estate of Ramsey Abbey) are compared with actual performance as ascertained by examination of manorial accounts of the early fourteenth century. To facilitate the comparison it is necessary to convert records of cheese and butter produced, these being the main forms in which dairy produce was stored, purveyed and consumed, to the annual lactage in terms of gallons per cow; this is done on each of two bases derived from later cheese and butter making recipes. The main comparison is with the manor of North Curry in Somerset which occupies the blunt end of a tongue of land surrounded by West Sedge Moor in the south and a similar pays on its northern flank. The manorial accounts of this manor for 1325/26 are of particular interest because of their unusually detailed account of both summer and winter cheese production which makes it possible to track the yield of cheese throughout the year, and to postulate what this implies in terms of milk production. Similar details from the account rolls of other manors in Somerset, Devon, and the estates of Peterborough Abbey and Bolton Priory are also adduced and lead to the conclusion that expectations were dependent upon counsels of perfection and ideal condition, which were rarely achieved; typical early-fourteenth-century yields being estimated at around one-seventh of those of the late nineteenth-century and only one-twentieth of those achieved by the modern dairy cow.

**Keywords:** Manorial accounts, milking, dairy produce

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### **TRANTALIDOU, K.**

*Companions from the Oldest Times: Dogs in Ancient Greek Literature, Iconography and Osteological Testimony.*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** In Attica the first known image of a dog comes from a vase of the third millennium B.C. In classical and Hellenistic Greece there are many representations of dogs in sculpture and iconography (Beazley's archives alone record 237), showing literally and metaphorically the relationship between humans and the "most vigorous of the domestic animals" as Pausanias tells us. Among those representations, one of the most tender is a Hellenistic sculpture of a small boy covering a dog with his arms (National Archaeological Museum at Athens). Dogs have provided for the practical, ideological and sentimental needs of man. They were complementary food animals in prehistory, and in later times in northern Greece symbols of power for the emerging nobles, who eclipsed even the king himself. They have served as religious attributes; funeral guards; companions in games and at home. From varying points of view, we will attempt to learn more about our common history with dogs through time.

**Keywords:** Greece, dogs, osteological presence, cultural representation

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#### **TRESSET, A. & BALASSE, M.**

*Estimating the milk and meat production of ancient herds: an aid to the interpretation of kill-off patterns from French Neolithic sites*

**Session:** Milk, Milking and Dairying

**Abstract:** Since Payne's foundation paper in 1973, much has been written on the topic of kill-off patterns interpretation. In particular, an impressive amount of literature is related to the question of the appearance of dairying and the antiquity of the phenomenon. Isotopic results obtained by the authors on cattle mandibles and teeth at the Neolithic site of Bercy (Paris, ca. 4000 BC) have revealed the coincidence between the age at which weaning occurred and a major peak identified in the kill-off pattern. This has led to identify a "post-lactation" slaughtering and to suggest that dairying may well have taken place on the site. Other Neolithic kill-off patterns in the Paris Basin display a similar feature and suggest that cow milk might have been an important resource during this period.

In parallel, kill-off patterns, as well as physiological and demographic parameters observed in modern unimproved breeds, have been used to estimate the milk and meat production of Neolithic cattle and sheep from the same region, and to evaluate the capacity of herds to increase. An evolution can be detected in the course of the Neolithic, and it principally affects the balance between these three main, hardly compatible,

options of the herd management : improving milk production, improving meat production or increasing the size of the animal population.

**Keywords:** Milk production, meat production, weaning process, physiological parameters, kill-off patterns.

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#### **TRESSET, A.**

*Neonatal sheep and bird wings: disentangling natural and anthropogenic factors in bone accumulations on the small islands of north-western Europe.*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** Marine birds - such as gull - regurgitate remains of crustaceans, fish, small birds, micro-mammals and rabbits. Remains of larger species (domestic mammals) are concerned equally, as they can be scavenged from rubbish dumps. Marine birds can also die en masse from illness or tiredness on nesting spots or be attacked by various predators (birds of prey, terrestrial carnivores, rats) when gathering in colonies during the season of reproduction. All this can lead to the creation of bone assemblages which can sometimes be difficult to distinguish from anthropogenic accumulations. This is particularly true on small islands, which are favourite places for nesting and where marine birds are abundant. In the same contexts, extensive sheep farming is usually developed and neonatal sheep, killed by the bad weather in number, can accumulate, particularly in natural shelters as rock cavities or megalithic tombs. This paper will rely on observations carried out in the Iroise area to discuss Neolithic assemblages from islands of southern Brittany and from Orkney.

**Keywords:** animal remains, natural accumulation, small islands, Brittany, Orkney.

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#### **TURNER, E.**

*Magdalenian Horse Hunters at the Site of Solutré (France)*

**Session:** Equids in Time and Space

**Abstract:** The site at the base of the Roche de Solutré is, without a doubt, the most famous prehistoric locality in Burgundy, France. Excavations at Solutré have revealed five cultural levels (Mousterian, Aurignacian, Gravettian, Solutrean and Magdalenian) in the thick deposits preserved at this site, reflecting repeated use of the locality from the Middle Palaeolithic through to the end of the Upper Palaeolithic. Solutré has been interpreted as a site where mainly horses were hunted, killed and processed. In this paper, data collected during an examination of horse remains from Magdalenian deposits at Solutré are presented. The paper focuses on skeletal part representation, age-structures, sexual demography, season of death and traces of modification in the form of cut marks, impact notches and carnivore gnawing of the horse remains. The results of the analyses support the theory that the Magdalenians hunted mainly horses at Solutré. Time of death of horses suggests that the site was probably used at varying times of the year. Characteristic of the assemblage of horse bones is the low number of humanly modified bones and the comparatively high number of bones gnawed by carnivores.

**Keywords:** Horses, archaeozoology; age-structures, skeletal part representation; butchery marks.

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## UCHIYAMA, J.

*Residential Base as a Hunting Camp: Subsistence Complex at Torihama Jomon Shellmidden*

**Session:** Beyond Affluent Foragers: the Development of Fisher-Hunter Societies in Temperate Regions

**Abstract:** Although the logistic mobility model has been successful to depict a statistic land use of prehistoric complex foragers, it failed to explain the process of economic change, in other words, how and why they shifted their mobility pattern, due to the negligence of the fact that foragers also control their own natural surroundings. The main policy of prehistoric foragers' manipulation of their environment was two folds. Firstly, the society developed their surroundings in the way to make it as suitable as possible for the biological requirement of their target resources. Secondly, they made it possible to carry out as various activities as possible in the vicinal area of their residential base. Once such an environmental manipulation occurred, the scale became larger and more complex until stopped by ecological crisis. By using the result of the analysis of the faunal assemblage from Torihama shellmidden site (Southern Honshu, Jomon Initial-Early phase, 7-5,000BP), the environmental manipulation system will be delineated and it will be concluded that the ecological crisis, caused by the manipulation, resulted in the disappearance of the site.

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## UDRESCU, M. & GABRIEL, A.

*Looking for human therapeutic intervention in the healing offractures*

**Session:** Beyond 'interesting specimens':

palaeopathology and its contribution to the study of animal husbandry

**Abstract:** Of all pathological conditions mentioned in archaeozoological literature, fractures represent only a minor fraction. Usually, little attention has been paid to the interpretation of healed fractures. In this paper the healed fractures mainly from several Roman and Medieval archaeological sites are presented. Emphasis is laid on the long bones (humerus, radius, ulna, metacarpal, femur, tibia, fibula and metatarsal) of domestic animals. The occurrence of healed fractures over the various parts of the skeleton varies among species and allows, together with the position in which the healing occurs, inferences about human interventions and decision-making when dealing with wounded animals.

**Keywords:** fractures, Roman, Medieval, palaeopathology

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## VALADEZ AZUA, R., RODRIGUEZ GALICIA, B & TEJEDA VEGA, S.

**Poster:** *Dog-wolf hybrid biotype reconstruction from the archaeological city of Teotihuacan in Prehispanic Mexico*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** Between 1992 and 1996 the archaeological project 'Tuneles y Cuevas' (Caves and Tunnels) of the Universidad de Mexico was conducted in the prehispanic city of Teotihuacan, located to the northeast of modern Mexico City. In the collection of identified canids (455 individuals), there were 20 which were considered, in the beginning, as possible wolves, because some of their cranial and dental characteristics were similar to the Mexican wolf (*Canis lupus baileyi*), even though their dimensions were smaller. In 1999 it was recognized that these individuals were really hybrids of wolves (*Canis lupus*) and dogs (*Canis familiaris*). The best example was the complete skeleton of a young animal, but there were many other individuals represented by just the inferior mandible and teeth. Their reconstructed shape is of a bigger dog with a wolf-like look, with a shoulder height of up to 20 inches, and length up to 30 inches. The data from the young individuals indicate a strong

asincrony in their development. Quantification of bone estrontium and zinc indicates that their diet was primarily herbivorous, with minimal access to meat. This condition could only be explained by owners who took care of them and gave them food. Most of the samples recovered were located in time between the VIII and XII centuries A.D., and were discovered inside caves, where they were put in locations oriented to the west. The association of the concept 'cave', 'west' and 'wolves' in Prehispanic Indian symbolism indicates that these animals were used in ceremonial rituals associated with the Sun Circle and the night space associated with the god Xolotl, an Indian god with a dog shape, who was considered the suns companion, but only in the night.

**Keywords:** Mexican dogs, Mexican wolves, dog-wolf hybrids, domestic American fauna, Mexican prehispanic fauna

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#### **VALENSI, P & PSATHI, E.**

*Faunal exploitation during the Middle Palaeolithic in South-East France and North-West Italy*

**Session:** Neanderthal ecology

**Abstract:** Several middle palaeolithic sites (Lazaret, Madonna dell'Arma, Caverna delle Fate, Arma delle Manie, Santa Lucia Superiore and San Fransesco), dated from isotopic stages 6 to 4, have been studied from a palaeontological, taphonomic and zooarchaeological point of view. These sites yielded faunal assemblages rich in Cervids and dominated mostly by red deer. The abundance of the rest of the herbivore taxa is strictly correlated to the topography of each site as well as prevailing environmental conditions. The study of mortality profiles, patterns of element representation and butchery marks concerns principally the red deer. It reveals systematic hunting of this animal, transport of the entire carcass to each site and wide exploitation by humans. The second species in terms of NISP/MNI, when well represented, shows similar patterns of exploitation. A different strategy (opportunistic hunting and/or scavenging) is suggested for large game animals. Finally, the function of each site is discussed.

**Keywords:** Neanderthal, Middle Palaeolithic, Liguria,

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#### **VAN NEER, W.**

*Traded fish: a luxury item or bulk food?*

**Session:** Equations for Inequality. The Archaeozoology of Identity, Status and Social Differentiation

**Abstract:** Surplus production of fish can occur because of their seasonal massive abundance. Preservation methods (e.g., sundrying, smoking, salting) were developed to prevent spoilage and to allow storage for future consumption. These fish products are also suitable for transport, even over long distances. A survey of the literature shows that more and more sites are reported with fish species that have been imported from distant areas. Typical examples include the Spanish mackerel (*Scomber japonicus*) and fish sauces found at Roman sites from Middle and Western Europe, or Nilotic fish found at Chalcolithic to Byzantine sites in the Near East. There has been a tendency in the past to see these special finds as an indication for high status. However, now that more fish remains are found due to better recovery techniques, it appears that these exotic food items are possibly not as exceptional as it was believed before. A survey of these finds is presented and it is questioned whether good arguments exist to see imported fish as luxury goods.

**Keywords:** fish, trade, status

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#### **VIGNE, J.D., HELMER, D. & PETERS, J.**

*New methods and the first steps of mammal domestication*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Analysing and understanding the first steps of the domestication of mammals, including the prehistoric spread of the domestics, is one of the main contribution of archaeozoology to the history of man and of the societies. This explains why this topic has historically been one of the most attractive (and debated too) in ICAZ Conferences. Though archaeozoology has considerably widened its fields of investigation, researches in first domestication remain today very dynamic. During last years, a lot of new data appear in new areas such as China, South-West Asia, Africa, as well as in the more traditional areas such as Europe, America and the Near and Middle East. These progresses result of course from the widening of archaeological through the world, but also from new methodological approaches. This session will focus on this methodological evolution in order to evaluate the relevance and limits of the different approaches, and finally to take stock on the role that

archaeozoology may play in the future in the general anthropological debate on the birth of domestication. Progress partly took advantage from new techniques such as molecular analysis of the present day diversity of domestic mammals, fossil DNA analysis of prehistoric bone or teeth, new osteometrical analysis which allows to distinguish shape from size, stable isotope analysis... Papers illustrating both potentialities and limits of these methods will be welcomed. However, improvements of more traditional osteo-archaeological techniques are also able to bring important progress. New criteria for taxonomic, age or sex determination or new methods for processing slaughtering ages or skeletal part frequencies must also be evaluated in the light of the result that they produce in different situations. Distinguishing wild from domestic populations, the question of either an exclusive appeal to morphological data or a use of more diverse criteria (skeletal part, age and sex frequencies, natural mortality...) should also be re-evaluated in the light of present day knowledge and of the possible relationships between early breeder human groups and their mammals in different environmental, historical and cultural contexts. A short round table at the end of the session will discuss the compatibility of the different systems for registering and processing osteo-archaeozoological data, on the way for a kind of homogenisation of practices. Indeed, we hope that all these questions can be debated not only in the restricted field of the Near East, but on a very wide geographical range.

**Keywords:** Early domestication, Palaeodemography, Morphometry, Fossil molecules, Archaeozoological technics

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## VILA, E.

*Some data about equids from the IVth and IIIrd millennium in North Syria*

**Session:** Equids in Time and Space

**Abstract:** Equid metrical data of several settlements located in North Syria are presented in this paper. Equid remains are yielded from levels belonging to the end of the IVth millennium, related to the Uruk culture (El Kowm, Tell Sheikh Hassan, Mashnaqa) and from the IIIrd millennium, Early Bronze Age (Tell Chuera, Tell Knedig, Mashnaqa). During these periods, identification difficulties between Asses (*Equus africanus*), which according to recent research were indigenous in this area, and Half Asses or Hemionus (*Equus hemionus*), are enhanced by the appearance of domestic asses (*Equus asinus*) and horses

(*Equus caballus*). The problem of *Equus hydruntinus*, known in Anatolia during the Neolithic, remains open since it was recently found in Iran during Chalcolithic and Iron Age. Although it is considered absent from Syria in proto-historical periods, this new situation leads to scrutinize the Syrian equids remains under this light. The first aim of this study is to present a set of equid measurements from settlements of this transition period.

**Keywords:** Syria, Chalcolithic, Early Bronze Age, African asses, Domestic asses,

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## VOSTRETISOV, Yu. I.

*Changes in Middle Holocene fishing patterns in the western part of the Sea of Japan*

**Session:** General

**Abstract:** Cultural evolution of prehistoric populations in the coastal zones of different regions of the world sometimes shows similarity of reaction to environmental changes. There were several phases of environmental change during the Middle Holocene. Study of shell middens of different cultures in the western part of the Sea of Japan shows that fishing patterns significantly changed during the Middle Holocene from lagoon fishing of the Boisman culture, 5500-5000 BP (18 species), to open sea fishing of the Zaisanovsky culture, 4800- 4400 BP (26 species), and the late Yankovsky culture, 2800-2300 y. BP (49 species). This change was nonlinear. The most dramatic and qualitative changes took place after the time of the Boisman culture and were connected with a cooling of the climate, the fall of sea level and the disappearance of most of lagoons. The change from the time of the Zaisanovsky culture to Yankovsky culture is more gradual and is more of a quantitative character. In addition, during Middle Holocene the role of fishing increased. Similar trends took place in other parts of world.

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## WARMAN, S.

*Predynastic Egyptian bovid burial in the elite cemetery at Hierakonpolis*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** At Hierakonpolis near Edfu a concentration of archaeological sites are undergoing excavations. The earliest of these sites date to the early-mid predynastic period - up to 3700BC. The elite cemetery site at Hierakonpolis (HK-6), has

provided a number of fascinating and unusual faunal remains. Several non-domestic and exotic species have been recovered over the long years of excavation, including elephant and baboon. The 1999 season produced a particularly interesting find: within grave cut number 19 a semi-articulated Bos skeleton was found. Further examination revealed that the specimen was of a very large size, which coupled with the bucranium lead to the suggestion that the individual might be a wild aurochs (*Bos primigenius*) rather than a domestic cow (*Bos taurus*). This poster will examine various aspects of this unusual burial, the skeletal elements present, the identification as an aurochs, the implications of earlier robbing/disturbance of the tomb, and the treatment of the carcass prior to burial and associated archaeological and environmental finds from the grave. This find offers an insight into the significance this species within the death rituals of the elite population at Hierakonpolis. Additionally it allows the archaeologist to trace behaviours and practices better known in the later Dynastic periods back to this early urban centre of Egyptian civilisation.

**Keywords:** Hierakonpolis, Elite cemetery, Predynastic, *Bos primigenius*, Ritual

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#### WARMAN, S.

*Two novel methods for the study of dental morphological variation in Sus scrofa in order to identify separate breeding groups within archaeological assemblages.*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Many studies of mammal bones and teeth have examined the differences between populations or breeding groups of animals, as represented by faunal assemblages. Such studies have often concentrated on variation in size, as determined by calliper measurements of specific dimensions. In analyses of assemblages of *Sus scrofa*, particular use has been made of the length of the 3rd molar, as a means of separating wild from domestic specimens. Within the dentition this tooth has been found to be very variable in its morphology even within populations, partially as a result of environmental factors as it is only present in fully mature individuals. The potential for study of the earlier erupting teeth such as the first permanent molar and fourth deciduous premolar is that they are present in younger individuals and are less likely to be affected by environmental factors, thus reducing the level of intra-population variation. Advances in morphometrics and methods of study developed in dental anthropology now offer some novel alternatives to calliper measurement based studies. Two methods will be proposed, firstly Eigenshape a statistical means of comparing outline shapes of cheek teeth regardless of size; and secondly, a system for the scoring of minor morphological crown variants. These methods will be described and preliminary results presented, leading into a discussion of their application to the identification of domestic stock within the archaeological record.

**Keywords:** *Sus scrofa*, dental morphology, population variation, Eigenshape analysis, minor crown variants

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#### WEBBER, J.

*Domestic or Commensal? Ritual Use of Animals at Southeastern U.S. Plantation Sites*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The enslaved Africans at southeastern plantations drew upon various cosmological belief systems. Certain of these systems call for the use of animals in their ritual observances. It is expected that this cultural activity would leave evidence in the archaeological assemblages from plantation sites. A number of potentially ritually-related faunal deposits have been recovered from such sites. The context of these deposits is discussed, and several possible explanations are explored.

**Keywords:** south-eastern United States, coastal plantations, pre-Civil War, ritual animal use, slave religion

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#### WEINSTOCK, J.

*Environment, body size, and sexual dimorphism in Late Glacial reindeer.*

**Session:** Ageing and Sexing

**Abstract:** The present study deals with the geographical variation in the body size of reindeer (*Rangifer tarandus*) in western and central Europe during the Late Glacial (ca. 12-10 ka BP). An osteometrical study of *Rangifer tarandus* revealed that a clear difference in size existed between the populations living in the North European Plain (Britain, northern Germany, and Belgium) and those living in more southern latitudes (southern Germany, Switzerland, and France), with the former being larger. The difference in size however, is not reflected equally in both sexes. Males in both areas commonly reached a similar size; females in the south, however, were usually much smaller than their northern counterparts. This phenomenon could be related to a differing availability of food resources during the summer. As a methodological corollary, this investigation shows that size comparisons between populations in different areas should be made for males and females separately.

**Keywords:** body size, reindeer size, sexual dimorphism, marginality

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### WEISSBROD, L. & BAR-OZ, G.

*Interpreting the fauna of the Late Bronze Age (LBA) Ara burial cave, Israel: some unconventional suggestions*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The faunal assemblage from Ara burial cave, Lower Galilee, Israel, dated to the Late Bronze Age (2nd millennium BCE) was recovered during a recent salvage excavation of the site. Systematic collection of large faunal remains was complemented with restricted retrieval of small faunal remains from within ceramic vessels. This was accomplished through fine sieving of their sedimentary fills in the laboratory. The large faunal assemblage (NISP of 423) is dominated by 92% sheep (*Ovis aries*) and goat (*Capra hircus*) and also includes cattle (*Bos Taurus*) and equids. The dominance of caprines and their age structure, which reveals selection of young individuals (under 36 months), conforms to the generally accepted interpretation of this type of assemblage as ritual offerings. However, a distinctive pattern of non-selective skeletal portion representation, together with an absence of bone clustering and their non-association with the vessels, strongly indicate *in situ* preparation and consumption of the animals. This is in accord with the alternative explanation of honorary ritual banquets. Variability in burial ritual traditions could account for the lack of consistent patterning in skeletal representation typifying LBA burial assemblages. The small faunal assemblage (NISP of 970) was comprised predominantly of a single anuran species (most probably *Pelobates syriacus*; ~91%) in addition to those of several micromammal species (mainly mole rats [*Spalax ehrenbergi*]). Small faunal material from Bronze Age sites has been considered either as intrusive or as the product of accumulation by predators. The good state of preservation of the remains from the Ara vessels coupled with nearly complete skeletal part representation are in agreement with these interpretations. Alternatively, the context of a sealed burial cave, the presence of the material within the vessels, and the anomalous absence of anuran cranial elements, would suggest intentional preparation of ritual food offerings.

**Keywords:** Near East; Late Bronze Age; small fauna; Anuran remains; animal burial offerings

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### WEISSBROD, L., WEINSTEIN-EVRON, M. & DAYAN, T.

*Taphonomy of the small mammal remains (rodents and insectivores) from el-Wad Terrace*

**Session:** Contribution to zooarchaeology of fossil and modern non-anthropogenic bone accumulations

**Abstract:** A widely held assumption is that nocturnal raptors (order Strigiformes) are the accumulating agent of micromammal remains recovered in archaeological sites situated in caves or at the base of cliffs. Nonetheless, other possible agents, natural and cultural, are also recognized. Among them are use of micromammals as a food source; commensalism of micromammals; and faunal turbation caused by burrowing species. A detailed taphonomic study of a sample of micromammal remains from the Late Natufian layer (11,000-10,500 YBP) of el-Wad Terrace, Mt. Camel, was carried out in order to test the role of owls as agents of accumulation. The variables inspected include standard quantitative measures (NISP, MNI and MNE), skeletal damage patterns, relative extent of skeletal loss and age distributions. The study was designed as a general model of the conjectured taphonomic sequence at the site. Its components are: 1. the prehistoric assemblage, constituting the end point; 2. barn owl pellets, representing the assumed point of origin; 3. micromammal remains from a niche in the cliff overhanging the site, representing an expected intermediate stage. Within this comparative framework it was possible initially to identify unique imprints created by various attritional processes in the two actualistic assemblages, and then to track them in the fossil assemblage. By factoring out the secondary influences of weathering, trampling, transport, burial, and excavation procedures, the distinct depositional pattern associated with nocturnal raptors was identified in both the niche and terrace assemblages. The degree of preservation of this type of primary information in the terrace is characterized as intermediate in relation to that of cave and open-air sites. Deviations from the general pattern of owl deposition provided indications for consumption of mole rats (*Spalax ehrenbergi*) by the Natufians and presence of commensal mice (genus *Mus*).

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### WHEELER, J.C.

*The contribution of archaeozoology and molecular genetics to the rescue and conservation of relict purebred alpaca and llama breeds*

**Session:** Role of Zooarchaeology in Wildlife Conservation Issues

**Abstract:** Archaeozoology and molecular genetics can make important contributions to our understanding of animal domestication and the subsequent development of breeds. In the Andes, where European contact largely destroyed native stock rearing and pre-conquest written records are absent, the role of these two disciplines is especially important. Naturally mummified 900-1,000 year old llamas and alpacas from the Osmore drainage in southern Peru provide a unique source of information on the physical appearance of pre-contact llamas and alpacas selectively bred by pre-Inca Chiribaya herders. Mitochondrial and nuclear DNA sequences from a large sample of modern camelids document generic separation of wild vicuña and guanaco, and confirm that, while the alpaca descends from the vicuña and the llama from the guanaco, extensive hybridization between the two has occurred. Although research on the mummies has not yet produced replicable DNA sequence data, study of their phenotypes provide base line data against which to measure changes in the contemporary population. Two probable ancient breeds of alpacas and three of llamas have been identified based, in part, on fleece characteristics and general morphology, while faunal remains from occupational sites reflect strict selection practices. Contemporary animals, in contrast, lack uniform phenotypes and most produce coarse fiber of low economic value. The break down in controlled breeding likely began at the conquest, when both the animal and human populations were reduced by 80-90% within a century of contact, and has continued to the present. DNA results indicate that only 20% of contemporary alpacas and 60% of llamas remain genetically pure, and the continuing practice of crossing male alpacas with female llamas represents a serious threat, especially to the survival of purebred alpacas. Utilizing data from the mummies and DNA testing, a program is being developed for rescue and conservation of relict breeds of purebred alpacas and llamas.

**Keywords:** alpaca, llama, endangered breeds, DNA, conservation

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## WICKLER, S.

*Competing Colonisation Models in Micronesia: the Faunal Evidence*

**Session:** Human and Animal Migration and Colonisation

**Abstract:** Archaeological models of colonisation and settlement in Oceania have been increasing informed by faunal evidence. However, recent literature on the zooarchaeology of migration and colonisation has focused primarily on Polynesia, and to a lesser extent Melanesia, rather than Micronesia. This paper attempts to redress the situation by reviewing evidence for animals introduced as both intentional and unintentional baggage accompanying the initial settlers of Micronesia and subsequent inter-island voyagers. Attention is focused on the western Micronesia archipelagos of the Marianas, Yap and Palau where variability in the suite of animals represented in archaeological

assemblages provides clues to early settlement and interaction (or the lack of it). Faunal evidence for settlement trajectories in eastern Micronesia and interaction between the two regions is also discussed as is the potential cultural significance of transformations in the faunal record over time within selected island groups.

**Keywords:** Micronesia, human colonisation, faunal assemblages

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## WIGEN, R.

*Stability in the face of change: Environmental change and resource use in Haida Gwaii (Queen Charlotte Islands), British Columbia, Canada*

**Session:** General

**Abstract:** Recent work on the post-glacial environment of the Queen Charlotte Islands has begun to give a clear picture of the dramatic environmental changes that occurred since the last glacial period. Over the last 16,000 years, the environment and vegetation changed from relatively dry, tundra like and sparsely treed to warmer, heavily treed and very wet. Sea level changes were major and astonishingly fast, falling dramatically to well below current sea level and rising at one stage to above the current level. There is as yet little archaeological evidence for the very early post-glacial period as these sites, if present, are under water. However, vertebrate faunal remains have been recovered from sites between 9500 BP to the contact period (about 200 BP). In these sites there is consistent use of a few main resources, in particular harbour seal, sea otter and rockfish. The few changes are the very recent loss of caribou to extinction about 1900 and the addition of salmon as one of the main resources. Compared to the dramatic environmental changes, the faunal record is remarkably stable.

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## WILKENS, B.

*Roman suovitaurilia and its precedents*

**Session:** Beyond Calories: the Zooarchaeology of Ritual and Religion

**Abstract:** The term suovitaurilia denotes a sacrifice of sheep, cattle and swine in a single ritual action. The Roman suovitaurilia, as described by numerous Latin authors, finds direct antecedents in the pre-Roman ritual of the Italic populations of which some archaeological and literary evidence remains. In comparison to the classical Roman suovitaurilia, some differences can be noted concerning the sex and the age of the slaughtered animals. Amongst the archaeozoological evidence, the faunal remains from the area of the archaic temples



of Eraclea in southern Italy are worthy of note. In many cases it is not possible to recognize from the archaeological context the single ritual actions and it is difficult to establish that a given example is more than a simpler sacrifice. Ritual remains of sheep, cattle and swine have also been recognized in more ancient periods of prehistory, but generally it is difficult to presume the killing of the three species was contemporary. Recently the study of the faunal remains from the shrine of Monte d'Accoddi in Sardinia (Chalcolithic) has demonstrated that a similar ritual was practiced. Consequently it is reasonable to think that the Roman suovitaurlia derives from a long tradition of preceding rituals.

**Keywords:** Suovitaurlia - Sacrifice - Romans - Italy - Sardinia

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### **WILKENS, B.**

*The sacrifice of dogs in ancient Italy*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** The sacrifice of dogs can be linked with funerary practices or ritual actions of different types. As regards the funerary role, the dog can be present in the grave together with the deceased or can be used in rites after the burial. In this study the cases not directly connected with burial will be examined. In Italy evidence of the slaughtering of dogs for ritual purposes is known from the ancient Neolithic to the Roman age. For the most recent periods, there is a great deal of literary evidence that indicates that this sacrifice refers to more ancient traditions, which often are not perfectly understood. As regards public cults, there is Chalcolithic evidence of dog sacrifices in sanctuary contexts, as a minor but constant component following the domestic species of greater importance. In these cases the dog is often butchered. The sacrifices of the private cult, practiced in the environment of daily life, are recognizable only with difficulty. As we can deduce from a reading of the Latin authors and pre-Roman texts, the dog was sacrificed on occasions of different sorts, some of which involved consumption of meat, while in other cases the dog was buried whole.

**Keywords:** sacrifice, dog, prehistory, Romans, Italy

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### **WILLIAMS, J.**

*Predator bias, fluctuating prey populations, and a host of other interactions.*

**Session:** Taphonomy

**Abstract:** In the investigation of small mammal taphonomy, it is now possible to recognise that there are specific trends that should be identifiable in most small mammal accumulations. The analysis of bone breakage and digestion enables the identification of many small mammal predators, with significantly higher levels of damage to bones produced by mammalian carnivores and raptors, than most owl species. Given this position, I will discuss what further information can be gleaned (aside from evidence of specific environments or phases of abandonment of archaeological sites), that warrants further study of small mammal assemblages. Drawing on specific archaeological data, as well as modern analogue material, I shall highlight some of the specific activities that can be identified in the fossil record, and attempt to discuss why understanding these predator-prey interactions is essential for future small mammal taphonomic research.

**Keywords:** owls, mice, predator-prey interactions

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### **WORLEY, F.**

*Potential taphonomic influence on cremation burial deposits and its implication for interpretation.*

**Session:** Taphonomy

**Abstract:** The cremation and subsequent burial of faunal material creates particular taphonomic scenarios that must be considered in its analysis. Anthropogenic factors are highly influential on the archaeological appearance of an assemblage but are effective together with the mechanical and chemical change of cremation and burial. This paper will consider this influence in three parts, firstly summarising the theory of morphological change during cremation as discussed by many authors (Bond 1996, Buikstra & Swegle 1989, Nicholson 1993, 1996, Shipman et al 1984, Sigvallius 1994) and the taphonomic effects of burial in various conditions. This will then be applied to a brief methodology for primary identification of osteological material. Secondly the paper will consider particularities in the derivation of secondary data from cremated faunal material. Finally the provisional results from an experimental cremation will be presented. Peculiarly among animal bone assemblages, cremated mortuary deposits can be seen to have specific intentionality. There is a significant difference of intent between the inclusion of a meat joint and the inclusion of a body portion intended to signify the whole animal. While human intent is not fully and accurately accessible to archaeozoological analysis in this area, an understanding of taphonomy helps greatly to focus on the most probable interpretation.

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**Keywords:** Cremation, burning, mortuary deposits

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#### WEISLER, M.I.

*Contrasting Subsistence Regimes on Two Remote Oceanic Islands*

**Session:** Behavioural Variability in the so-called Marginal Areas. A Zooarchaeological Approach

**Abstract:** Marginal areas are often limited in ecological variability with attendant low diversity of marine and terrestrial biota. This is especially true of the Indo-Pacific biotic province at the periphery of eastern Polynesia, and the low rainfall zone north of 10° N latitude in eastern Micronesia. These regions provide excellent opportunities to examine the range of adaptations that were required to sustain small human colonising groups in environmentally extreme conditions. The results of a multi-year programme at the raised limestone (makatea) island of Henderson (southeast Polynesia) exemplifies colonisation of a resource-poor island in a geographically marginal setting. At only 236 hectares, Utrök Atoll, the most northerly, permanently inhabited low coral atoll in the Marshall Islands (eastern Micronesia), is characteristic of adaptation to a low rainfall regime with limited land area, but an enormous encircling reef. The mechanisms that fostered range expansion to these marginal areas are examined. Perhaps more importantly, the social conditions that sustained colonies at the edge of sustainability are explored.

**Keywords:** adaptation, marginal environments, Pacific islands, atolls, Henderson island

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#### WEISSENGRUBER, G., FORSTENPOINTNER, G., KUNST, G.K. &

#### ARTEMIOU A.

**Poster:** *Investigations in the Differentiation of Equids (Horse, Donkey, Hinny, Mule) by Means of Computed Tomography*

**Session:** Equids in Time and Space

**Abstract:** The three long bones of the pelvic limb (os femoris, tibia, os metatarsium III) of equids (horse, donkey, hinny) were examined with regards to their distinguishing properties. Differentiation was based on traditional osteometric data and on measurements of compacta-thickness and -density, obtained by means of computed tomography. Cross sectional images of each bone were obtained at 10%, 30%, 50% 70% and 90% of the greatest length of the bone. The study mainly based on well-determined skeletal elements of horses (12 ossa femoris, 12 tibiae, 16 ossa metatarsia III), donkeys (21 bones of 7 pelvic limbs) and hinnies (10 ossa femoris, 8 tibiae, 9 ossa metatarsia III). Additionally bones of a mule (3 bones of one limb), of a Przewalski-horse (6 bones of 2 limbs) and long bones of unknown equids from archaeological sites were investigated. A method of differentiation with a high grade of reliability (ratio of correct answers: >90%) was developed by means of discriminant analysis. The use of this procedure for determination of archaeological findings is handicapped by an irregular decrease of compacta-density, most probably due to the influence of long-termed, soil-dependend structural changes. Distinguishing of a big part of fossilized bones in this study was enabled, however, using density-independent discriminant functions and by graphic evaluation of statistic features. The presented technique of differentiation surely introduces a remarkable improvement of the archaeozoological distinguishing-methods being in use until now. The enabling of taxonomic identification of equine metatarsal bones deserves special attention. Investigations on the biomechanical properties of equine long-bones could be another possible use for the obtained data. Remaining methodic inadequacies could be improved by an enhancement of the data-basis as well as by introducing additional parameters of measurement.

**Keywords:** Archaeozoology, osteometrics, computer tomography, equids, discriminant analysis, long bones

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#### YAMAZAKI, K., TAKAHASHI, O., SUGAWARA, H., ISHIGURO, N & ENDO H.

*Wild pig remains from the Neolithic (Jomon period) sites on the Izu Islands and in Hokkaido, Japan*

**Session:** General

**Abstract:** Jomon wild pigs have been found on the Izu Islands and in Hokkaido where no wild pigs exist today. It has been

suggested that the Jomon people carried the pigs (wild or domesticated) onto the islands from Honshu and kept or domesticated them. We examined bone remains excavated from 8 archaeological sites in Hokkaido, 6 sites on the Izu Islands and 28 sites from Honshu. The Log Size Index (LSI) of ancient wild pigs shows that Hokkaido populations were larger than Honshu groups, but Izu Islands populations were significantly smaller than Honshu groups. Age estimation based on tooth eruption and wear suggests that Hokkaido and Izu Islands populations differed from those in Honshu. Namely, the Islands populations lacked sub-adult animals. On the other hand, Honshu populations consisted of young to fully adult animals. The archaeological remains of pigs from the islands were classified into the Japanese wild pig (*Sus scrofa leucomystax*) by analyzing mitochondrial DNA, which confirmed that pigs were carried to the islands by the Jomon people from Honshu. Furthermore, mandibles of recent Japanese wild pigs from various geographical locations were examined. Analyses of the geographical variation in size and shape suggest that body size was larger in the colder areas than in the warmer regions. However, the dwarfism might be related to the size of the island and the altitude as well as to Bergmann's rule. These results suggest that the Jomon people introduced these animals to the islands. Thus, we should also examine the possibility of domestication in the Jomon period.

**Keywords:** Neolithic, Japanese wild pig, Log Size Index, mt DNA, dwarfism

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## YATES, B.C.

*The Evidentiary Dog: A Review of Anthrozoological and Archaeozoological Studies of Canis*

**Session:** Dogs and People in Social, Working, Economic or Symbolic Interaction

**Abstract:** An undeniably long relationship exists between *Canis* and *Homo*, and several disciplines exist that explore those relationships. In many instances, interdisciplinary efforts produce more significant solutions to research questions when stimulated by inquiries of specialists in seemingly disparate

interest groups. For example, the examination by wildlife forensic scientists of evidence items of canid origin may require consultation with geneticists and taxonomists, as well as with archaeozoologists experienced in recognizing taphonomic effects by soil microbial actions and modifications by humans. An animal behaviorist may provide clues to osteological differences between wolves and dogs attributable to different gaits and biomechanics. The need to differentiate wolf/dog hybrids for legal purposes has stimulated reinvestigation of the phylogenetic origins of the domestic dog and a re-examination of early dog remains and their osteometric analyses. A review of the uses and sometimes the abuses of dogs found in the writings of these scientists as well as historians, art historians, folklorists, veterinarians, and animal rights activists, illustrates the breadth of our involvement with the dog family and how to appreciate that extensive association in the material record.

**Keywords:** dogs; wildlife trade; morphometrics; morphology; anthrozoology

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## YESNER, D.

*Discussant*

**Session:** Exploitation and Cultural Importance of Marine Mammals

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## YUAN, J.

*The horses of the mausoleum of the First Emperor of Qin in Shaanxi, China*

**Session:** Equids in Time and Space

**Abstract:** Qinshihuang was the first emperor of a unified China. He lived from 259-210 BC and was buried in a mausoleum 6 km east of the Lintong area of Xi'an City in Shaanxi. Surrounding the burial mound are various pits containing objects to accompany the deceased. The excavations of grave good pit number 6 at the mausoleum has revealed one wooden chariot, 12 terracotta warriors and many horse bones. According to skeletal analysis of the horse assemblage, we can confirm that the minimum number of individuals (MNI) is nine, all of which were interned in the pit after first being killed. After measurement and calibration we have determined that the average horse body length was about 206 cm, the average height of the head was approximately 165 cm and the average height at the shoulders was close to 132 cm. The forelimbs were 77 cm long and the rear limbs were 82 cm long on average. All of the individuals represented were more than ten years in age. There are three maxilla that are sufficiently well preserved to confirm whether or

not the horses had canines -- all had canines present (suggesting they were non-castrated, adult males). There are six mandibles from which a similar confirmation can be made and in five of these six cases canines are found; one was lacking canines. Of the four pelvic bones that were discovered, all of them demonstrate characteristics that are consistent with those of male horses. Taken together, this evidence suggests that most, if not all, of the horses placed within this context were male horses. All of the terracotta and bronze horses found in grave good pit number 1 and in the bronze chariot pit at the Qinshihuan Mausoleum were horses that pulled chariots. We can clearly see that these horses all had penises but did not have testicles, and were therefore all depicted as castrated. This is certainly the earliest definitive evidence we have of castration in China -- dating to at least 2210 years ago. Additionally, the genitalia of the horses for riding -- discovered in grave good pit number 2 at the mausoleum -- include not only penises, but also testicles, which suggests that these types of horses were not depicted as castrated. This demonstrates that castration was used selectively for certain purposes. Possibly all horses used for pulling chariots were castrated, while war horses were left unneutered. Based on the comparison of terracotta horses, bronze horses and real horse remains from the pits accompanying the mausoleum of the first emperor of Qin, it appears that in terms of evidence of genitalia, the terracotta horses and bronze horses are not consistent with the zooarchaeological evidence from horses that were actually used to pull chariots.

**Keywords:** China, pit, male horse, castrate  
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#### **ZEDER, M.A.**

*Reconciling rates of long bone fusion and tooth eruption and wear in sheep, goats, and gazelle*

**Session:** Ageing and Sexing

**Abstract:** Age determination by long bone fusion and tooth eruption and wear patterns are methods used by zooarchaeologists around the world to build mortality profiles of archaeofaunas. These profiles, in turn, are used to reconstruct hunting and herding strategies fundamental to understanding the life ways of people of the past. However, the empirical grounding for these techniques is shaky at best. Controlled studies rates of long bone fusion and tooth eruption and wear in modern populations are rare. There is almost nothing in the literature on the reconciliation of these two techniques. Critical questions about the validity and meaning of these data remain unanswered. Are the sequences of skeletal fusion and tooth eruption and wear which archaeologists use to construct these profiles uniform in a large population of animals? Are they consistent across closely related species? How well do maxillary eruption and wear rates match those of mandibular teeth? Do the ages provided by long bone fusion match those derived from tooth data? Do these patterns vary by sex, region, or domestic

status? Three large collections of modern sheep (61), goat (41), and gazelle (22) skeletal remains from Iran and Iraq are examined with the aim of addressing these central questions.

**Keywords:** age determination, epiphysial fusion, tooth eruption, tooth wear rate

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#### **ZEDER, M.A.**

*New Perspectives on Livestock Domestication in the Fertile Crescent*

**Session:** New Methods and the First Steps of Mammal Domestication

**Abstract:** Three major livestock species were domesticated in the Fertile Crescent around 9 to 10,000 years ago: goats in the eastern Fertile Crescent region, sheep to the north and west in the central arc of the crescent, and pigs farther west in southeastern Anatolia. In all three cases, animal domestication was intricately involved with post-Pleistocene climatic change, and the spread of small-seeded annual grasses and nut-bearing trees, and the increasing reliance of people on these resources. New evidence of initial domestication goat in the eastern fertile crescent is presented and compared to existing understanding of the domestication and spread of sheep and pigs in the region. It is proposed that a fully understanding of livestock domestication can only be gained with a change methodological approaches to detecting initial domestication, a change in regional focus, and a new openness to sharing data and access to collections by international researchers working on the domestication and dispersal of domestic animals in the Old World.

**Keywords:** Domestication, Goat, Sheep, Pig, Methodological approaches

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#### **ZEILER, J.T.**

*Working in a commercial setting*

**Session:** Archaeozoology and Archaeological Heritage Management

**Abstract:** Archaeology in The Netherlands is going through major changes. Until recently it was a discipline restricted to universities, the National Service for Archaeological Heritage and municipal archaeologists. In the past few years, however, the number of private companies working on a commercial basis has grown considerably. By now there are about 50 companies,

covering a wide scale of activities. This increase was caused by two factors. Firstly, from the 80's onwards hardly any jobs for university graduates were available at the archaeological institutes, as a result of measures of economy. This left graduates with two choices: either find a job outside archaeology or to work in archaeology on a commercial basis. This caused the first wave of private companies. Secondly, the implementation of the Valletta Treaty will create an "archaeological market", as it will lead to a considerable increase in work - more than can be done by the "traditional" institutes. Moreover, more money for archaeological research will be available. These forthcoming changes have caused the second wave of private companies. In reality, although the implementation of the Valletta Treaty is yet to be realized, the "market" is already existent, and some large-scale projects have already been carried out along the lines of "Valletta". Apart from analyzing these changes more in detail, this lecture will deal with the activities of a small private

company specialized in archaeozoology will be discussed: the acquisition and realization of research projects, cooperation with other (specialized) companies and the (dis-) advantages of working in a commercial setting. Furthermore, the possibilities and impossibilities for (small) private companies in the new archaeological system will be discussed, as will be their role in integrated studies of archaeological sites within a team of (non-)commercial archaeologists and specialists, whether or not within the framework of the National Research Agenda.

**Keywords:** (Commercial) Archaeology, The Netherlands, Changes and prospects

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