

Draft Program

From Anthrosphere to Lithosphere (and back again): A Celebration of the Career and Research of Terry O'Connor

The 36th Annual Association for Environmental Archaeology Conference

Friday 6th November, 2015

5.00 pm – Registration

6.00 pm – Keynote presentation (Don Brothwell, Mark Maltby, Naomi Sykes, Lee G. Broderick)

7.00 pm – Drinks reception

Saturday 7th November, 2015

9.00 am – Registration

9.40 am – Digestive Taphonomy in Archaeobotany: A Gnawing Problem (Don O'Meara)

10.00 am – A Feast of Ducks? The Taphonomic History of Faunal Remains from Oakington Anglo-Saxon Cemetery (James Nottingham, James Morris & Duncan Sayer)

10.20 am – Profiling Taphonomic History through Bone Fracture Analysis (Emily Johnson, Pip Parmenter & Alan Outram)

10.40am – What doesn't Kill me makes me Stronger: How to turn the Taphonomic History of (Sub)Fossil Small Mammal Assemblages into Archaeozoologists' Favour (Borut Toskan)

11.00 am – coffee

11.40 am – Reading the Bones: Multiple Interpretations of Human Activity in Doghole Cave, Cumbria (Hannah O'Regan, Ian Smith, Kirsty McLeod & Dave Wilkinson)

12.00 pm – Reassessing the Irish Cave Fauna (Ruth Carden)

12.20 pm – Faunal Contextualisation of Mixed Human and Animal Assemblages from the Yorkshire Dales (Erin Kennan & Terry O'Connor)

12.40 pm – Blood from a Stone: Petrosals and Ancient DNA (Victoria Mullin)

1.00 pm – lunch

2.00 pm – Reconstructing Past Herbivore Abundance using Dung Fungal Spores: A Taphonomic Approach (Eline Van Asperen)

- 2.20 pm – 50 Shades of Gray: Using Biomolecules to Identify Ancient Remains of the Atlantic Gray Whale (*Eschrichtius robustus*) (Camilla Speller, Meriam Guellil, Anne Charpentier, Ana Rodrigues, Armelle Gardeisen, Klass Post, Matthias Meyer, Matthew Collins & Michael Hofreiter)
- 2.40 pm – Site Ecology and Environment at the Bradford Kaims; Phytoliths and Thin-Sections as Indicators of Burnt Mound Depositional Sequences (Tom Gardner)
- 3.00 pm – Sweet Chestnut (*Castanea sativa*) in Britain – Using New Techniques and Information to Test its Status as an ‘Archaeophyte’ of Roman Origin (Rob Jarman, Frank M. Chambers, Julia Webb & Karen Russell)
- 3.20 pm – coffee
- 4.00 pm – Isotopic Landscapes: Faunal $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from the Thames Valley (Julie Hamilton, Julia Lee-Thorp, Gary Lock, Robert E.M. Hedges)
- 4.20 pm – Using Modern Analogue Coleopteran (Beetle) Datasets to Quantify Landscape Cover and Human Activity (Geoff Hill, Nicola J. Whitehouse, Helen M. Roe, David N. Smith & Ingelise Stuijts)
- 4.40 pm – Developing Understanding of Ephemeral Mesolithic Sites through Geoarchaeological Techniques (Charlotte C.A. Rowley, Aimée Little, Shannon Croft, Emma Tong, Charles A.I. French, Chantal Conneller, Barry Taylor & Nicky Milner)
- 5.00 pm – Exploring Extinction and Community Biodiversity using Niche Models (Nicola J. Whitehouse, Georgina Milne & Alison Cameron)
- 5.30 pm – AGM
- 7.00 pm – Conference Dinner

Sunday 8th November, 2015

- 9.00 am – Registration
- 9.40 am – There's more than one way to Skin a Cat: Equifinality and Developer-Funded Archaeology (Suzi Richer, Andrew James & Edward Blinkhorn)
- 10.00 am – Four Decades of Environmental Archaeology Pedagogy in Nigeria. And so what? (Kingsley Chinedu Daraojimba)
- 10.20 am – The Debateable Territory where Geology and Archaeology Meet: Reassessing the early Archaeobotanical Work of Clement Reid and Arthur Lyell at Silchester (Lisa Lodwick)
- 10.40am – From Coring Point to Landscape: Using Pollen Dispersal Modelling to Explore Hypotheses of Archaeological Landscape Organisation and Change (M. Jane Bunting)

11.00 am – coffee

11.40 am – The Archaeology of Excrement: The Passed and the Present (Andrew K.G. Jones)

12.00 pm – Urban Animals: People and Poultry in later Post-Medieval Belfast (B. Tyr Fothergill)

12.20 pm – The Blood of the Beasts: The Social Taphonomy of Cattle Bones in a Mediaeval City (Lee G. Broderick)

12.40 pm – Medieval Towns under the Microscope: Integrating Micromorphology, MicroXRF and Phytoliths (Barbora Wouters, Yanick Devos, Karen Milek, Luc Vrydaghs)

1.00 pm – lunch

1.55 pm – IGNITE session

2.20 pm – Herd demographics in zooarchaeology: a critical, simulation-based assessment of the viability of the standard mandibular approach (David Orton & Jesse Wolfhagen)

2.40 pm – Super furry animals: locating foxes and badgers in Anglo-Saxon life (Kristopher Poole)

3.00 pm – Zooarchaeology of Emotion and Grief (James Morris)

3.20 pm – coffee

4.00 pm – Nest Egg: The role of eggs in reconstructing past avian-human relationships (Julia Best)

4.20 pm – Diverse Ritual Practices in two Late Roman Landscapes, or, Where's My Cow? (Clare Rainsford & David Roberts)

4.40 pm – Human-Animal relations in Iron Age Wessex: A histological study of pit deposits from the Danebury Environs, Hampshire, UK (Richard Madgwick & Tom Booth)

5.00 pm – Variation of Apodemus mandibular morphology during the Holocene: functional implications (Elizabeth Kerr, Anne Tresset, Anthony Herrel & Raphaël Cornette)

Digestive Taphonomy in Archaeobotany: A Gnawing Problem

Don O'Meara
Durham University

The work of Professor Terry O'Connor was first encountered by me as an undergraduate student. His text book 'Environmental Archaeology' with John Evans, and his core text *The Archaeology of Animal Bones* were the two key texts which influenced me (and no doubt many others) to become an environmental archaeologist. Other influences directed me towards archaeobotanical research and it is in this field this presentation is situated. Though my main area of research is in archaeobotany the emphasis Professor O'Connor gave to taphonomy had a lasting impact on my work. Perhaps slightly oddly it was his text *The Analysis of Urban Animal Bone Assemblages* which formed the original methodological basis for my archaeobotanical study of medieval cesspit remains. Specifically I was interested in the very different ways taphonomy is treated in zooarchaeology and archaeobotany. Because of the different origins of each field digestive taphonomy has been a keystone of zooarchaeology research (including O'Connor's own contribution on cat gnawing with Moran), whereas in archaeobotany it has rarely been examined via experimental research. This presentation presents the results of digestive taphonomy experiments on botanical material as part of a study to understand the formation of urban cesspit assemblages. Though this type of work demonstrates the different manner in which taphonomy has been approached by the two fields it also demonstrates how archaeobotanical studies can learn from the manner in which zooarchaeology devotes such careful attention to taphonomic issues. It also raises questions about how archaeobotanical studies treat the 'invisible' botanical material; plants with strong presence in the historical record but few or no archaeobotanical records. Though many environmental archaeologists will never have worked with Professor O'Connor this presentation demonstrates that even outside the zooarchaeological field he has left a lasting impression on many environmental archaeologists.

A Feast of Ducks? The Taphonomic History of Faunal Remains from Oakington Anglo-Saxon Cemetery

James Nottingham, James Morris & Duncan Sayer
University of Central Lancashire

When we consider the animals present in mortuary rites of the early Anglo-Saxon period, the majority of archaeologists first think of horse burials associated with inhumations and cremations. However, other animal remains were also present in Early Anglo-Saxon burials. The example of an articulated cow at the early Anglo-Saxon cemetery at Oakington, Cambridgeshire demonstrates the variability observed in these deposits. Furthermore, animal burials are not the only pathway in which faunal remains appear in the archaeological record. Animal remains are often recovered from grave fills, sometimes as partially articulated bone groups, and frequently as individual elements. Often the faunal remains may be viewed as 'offerings', but the process of defining these grave goods can prove problematic, with residual animal bone being part of the sedimentary clast obscuring the picture. A key in analysing these bones is to identify the cultural and natural taphonomic transformations present in the assemblage.

Using a taphonomic model to consider pre and post-depositional histories, a faunal assemblage of 526 animal bones from the graves at the Anglo-Saxon cemetery of Oakington, Cambridgeshire was analysed. Consideration of the faunal, taphonomic and associated archaeological information enabled purposeful and residual grave deposits to be identified. The project identified 18 elements forming placed deposited in graves, some of which were missed during excavation. These deposits vary from a ducks wing to pigs' trotters, many of which were present in infant graves. It also identified the varied taphonomic histories of the assemblage. Overall, this approach allows zooarchaeologists to shed light on the grey area surrounding purposefully placed deposits and further enables us to consider the nature of early Anglo-Saxon funerary activities.

Profiling Taphonomic History through Bone Fracture Analysis

Emily Johnson, Pip Parmenter & Alan Outram
University of Exeter

Taphonomy is an especially important consideration for all archaeologists interpreting material from archaeological sites. This paper presents a new method of assessing and displaying taphonomic history through detailed bone fracture analysis. Bone is a particularly useful material for taphonomic analysis as it is sensitive to when it was broken, depending on the degree of decomposition over time. The resulting Fracture History Profiles show the sequences of fracture and fragmentation that have affected a bone specimen from the death of the animal to recovery by archaeologists. The method firstly provides an assessment of the carcass processing traditions of past people, relating specifically to bone marrow and bone grease extraction. Secondly, by analysing post-depositional fracture in addition to bone modifications such as burning, gnawing and taphonomic agents, it is possible to reconstruct a comprehensive taphonomic history for each archaeological context. This has implications for other artefacts in the same context that have no equivalent diagnostic features, and is perhaps the most widely applicable use of Fracture History Profiles. This method will be demonstrated using case studies from the Linearbandkeramik and other Neolithic cultures.

What doesn't Kill me makes me Stronger: How to turn the Taphonomic History of (Sub)Fossil Small Mammal Assemblages into Archaeozoologists' Favour

Borut Toškan
Institute of Archaeology ZRC SAZU

Small mammals from archaeo(zoo)logical contexts are often seen as being very indicative of past habitats. Traditionally, the ecological tolerance of recent populations of various species is projected onto conspecific populations from past periods. Nevertheless, there are some pitfalls to the process that are to be considered, which are in great part linked to the neglect of the taphonomic history of the studied archaeozoological assemblage. If, however, taphonomic processes are properly understood, an even deeper insight into the past environments can be obtained relative to what would be expected from the interpretation of the ecological tolerance of individual small mammal taxa alone. This is shown in practice by presenting two case studies of micromammal remains originating from prehistoric pile-dwelling sites from Ljubljansko barje (Central Slovenia). In the case of Resnikov prekop (4,600 BC) the taphonomic analysis revealed that small mammal remains are clearly not coeval with large mammal bones found at the same location, which contributed to the discovery that some time in prehistory a watercourse traversed the site and washed away the settlement's cultural layer. In the case of the assemblage of Stare gmajne (2nd half of the 3rd Millennium BC) the identification of the tawny owl (*Strix aluco*) as the principal agent of collection of the studied material allowed for the localization of the distance between the village and the closest forest to have been less than 100 m, suggesting that fields and pastures must have been mostly located at some distance from the lake shore.

Reading the Bones: Multiple Interpretations of Human Activity in Doghole Cave, Cumbria

Hannah O'Regan¹, Ian Smith², Kirsty McLeod², Dave Wilkinson²

1. University of Nottingham, 2. Liverpool John Moores University

Doghole Cave has yielded the largest assemblage of Romano-British human remains (MNI = 28) from a cave in northern England. It has also yielded a late IA-early RB horse burial and a number of neonatal pigs, cattle, sheep and humans, as well as many older individuals of these same taxa. Charcoal from the site has been identified as lime, birch, oak and hazel, and includes an RB charcoal-rich layer containing calcined sheep remains. The site is multi-period and it is likely, based on our radiocarbon dating results, that many of the adult animals date from the early Medieval period. What does it all mean? This paper will explore the many different hypotheses that we have considered to explain the species, age, and body part distribution of the remains within the cave, and discuss what this may tell us about both about cave taphonomy and about rural activity away from the military regions of Roman Britain. Our results also emphasise the importance of sieving when dealing with such deposits.

Reassessing the Irish Cave Fauna

Ruth Carden

National Museum of Ireland

From the 1850s to the mid-1930s, 34 cave sites in Ireland were extensively explored and excavated. The excavations were led by the leading scholars of that time (e.g. Adams, Plunkett, Ussher and Scharff). At least 11 of these caves have evidence of human remains and/or cultural use in conjunction with the presence of animal remains. It is estimated that more than 300,000 vertebrate bone fragments and artefacts were recovered from these cave sites and the majority of this material is archived within the National Museum of Ireland collections. The animal bones were identified post-excavation by NMI staff and other leading experts in Britain at that time and these original identifications and listings still influence contemporary histories of the vertebrate fauna of Ireland and indeed conservation policy in terms of priority of perceived native species.

The mid 1990s Irish Quaternary Fauna Project (IQFP) dated 64 bones from various caves, thereby establishing chronologies of the presence/absence of particular vertebrates and allowing better assessment of inferred environmental and ancient climatic changes. Subsequently, many scientific researchers have used the IQFP dated bones to extract ancient DNA (aDNA) to determine origins, colonisation events and species-specific relationships in phylogeography studies.

However, there are numerous species misidentifications of the bone fragments, as per original listings, as well as large volumes of identifiable fragments which were unidentified. Since animal bones are part of the palaeontological and archaeological records, it is vital that their identifications are correct. This research set out to critically re-examine the vertebrate cave assemblages and (re)identify and analyse all of the faunal remains, in conjunction with the potential reconstruction of contextual/other information based on the excavation notebooks. Results thus far indicate that these faunal records can still provide crucial and salient insights to our understanding of human presence and human-animal relationships.

Faunal Contextualisation of Mixed Human and Animal Assemblages from the Yorkshire Dales

Erin Keenan¹, Terry O'Connor²

1. Texas State University, 2. University of York

The Yorkshire Dales contain many caves which house prehistoric anthropogenic material. Much of this material is osteological in nature, with both human and animal remains represented. Previous studies have focused on the human remains, with little attention paid to what rigorous study of the faunal material can reveal about prehistory in northern England. This study addresses this by considering the faunal material recovered from three cave sites in the Yorkshire Dales: Cave Ha 3, Thaw Head Cave, and Kinsey Cave. Materials from these three sites have been dated to the Neolithic, allowing insight to be gained about the comparatively understudied and poorly understood period in northern England. Results indicate shifts in cave use over time, including for shelter, burial, and carcass processing, as well as broader human-environmental interaction. There is room for great improvement of these conclusions by an expansion of this study to include a larger number of sites, and targeted dating of faunal materials to increase our understanding of what was happening when. Thus, this study may be viewed as a glimpse into the possibilities for improved understanding of the Neolithic within this region.

Blood from a Stone: Petrosals and Ancient DNA

Victoria Mullin
Trinity College Dublin

Over the past 30 years the field of ancient DNA (aDNA) has progressed from the amplification and sequencing of small fragments of DNA, to the sequencing of complete genomes. Along the way the field has aided in the taxonomic identification of archaeological specimens and shed light on the population histories of both extinct and extant species.

Prior to the latter half of the last decade, the aDNA field was dominated by mitochondrial studies, which whilst informative, lacked the genetic power for in-depth population genetic analyses. In recent years technological advance, brought about by high throughput sequencing technologies, has meant that full genome DNA sequencing has become widely accessible to the scientific community. However, even with this access to relatively low cost high volume DNA sequencing full ancient nuclear genomes can still prove elusive, mainly due to the low amount of high quality DNA that is routinely extracted from archaeological remains. To increase the chances of extracting the quantities of DNA needed for genome scale aDNA analysis, the targeting of certain dense skeletal elements such as the shafts of long bones, metacarpals, metatarsals and teeth has been common practice.

Due to its relative lack of use for species identification the petrous portion of the temporal bone has, until recently, been overlooked by many as a resource for aDNA. With its name deriving from the latin for “stone like”, one of densest bones in the body is providing the field of ancient DNA with its very own “technological” advance. As we gather an increasing collection of sequenced zooarchaeological petrosal bones, it is becoming clear that working with this bone element greatly increases the chances of retrieving the high quantities of good quality DNA that will make the production of hundreds if not thousands of ancient genomes a reality.

Reconstructing Past Herbivore Abundance using Dung Fungal Spores: A Taphonomic Approach

Eline Van Asperen
Liverpool John Moores University

Although the study of animal bones can answer a wide range of archaeological and palaeoecological questions, it remains difficult to reconstruct past animal abundances. Recent decades have seen an increase in the use of spores of coprophilous (dung-inhabiting) fungi from sedimentary and archaeological sequences as a proxy for large herbivore abundance, in particular to answer questions regarding the human role in the Late Quaternary megaherbivore extinction and Mesolithic and Neolithic forest clearance and livestock impacts. Although this

novel proxy has great potential for advancing our understanding of past herbivore populations, current research in this area is mostly qualitative and lacks a strong experimental basis. In particular, environmental and taphonomic factors influencing preservation and recovery of these spores are poorly understood.

I present the results from a study using pollen (Tauber) traps to assess the impact of environmental factors and animal densities on dung fungal spore representation. The traps were placed at 11 locations in Chillingham Wild Cattle Park, Northumberland, UK. The park is inhabited by a herd of ~100 wild cattle. The park is also frequented by fallow and roe deer, as well as badgers and a variety of smaller mammals. The pollen trap locations represent a range of moisture levels, habitats and animal densities. Sampling periods ran from October-March and April-September. Soil and moss samples were also taken from the same locations. Spore influx (pollen traps) is compared with preservation and accumulation rate in the soil and moss samples, enabling an investigation of the impact of moisture levels, vegetation cover and herbivore presence on dung fungal spore abundance.

50 Shades of Gray: Using Biomolecules to Identify Ancient Remains of the Atlantic Gray Whale (*Eschrichtius robustus*)

*Camilla Speller¹, Meriam Guellil¹, Anne Charpentier², Ana Rodrigues³,
Armelle Gardeisen³, Klass Post⁴, Matthias Meyer⁵, Matthew Collins¹,
Michael Hofreiter⁶*

1. University of York, 2. University of Montpellier, 3. Centre National de la Recherche Scientifique, Montpellier, 4. Natural History Museum Rotterdam, 5. Max Planck Institute, 6. University of Potsdam

Whales are among the most threatened mammals, mainly as a result of relatively recent industrial overhunting. The impacts of pre-industrial whaling and the role of climate change have also been considered for the decline of certain species, particularly the Atlantic gray whale, thought to have gone extinct in the 18thC. Historical sources suggest that gray whales were caught in shallows and estuaries in the southern North Sea and English Channel from the 10thC - whale meat was certainly common and cheap in medieval markets. Zooarchaeological data suggest that gray whales may once have even fed and calved with the Mediterranean along France's southern coast. Documenting their former abundance and distribution, however, is hampered by the notorious difficulty in morphologically identifying cetacean bones to species. This project explored the use of biomolecular methods to validate the taxonomic identifications of 50+ putative paleontological and archaeological gray whale remains. We applied a variety of methods, including collagen peptide mass fingerprinting (ZoomS), mitochondrial DNA (mtDNA) barcoding through targeted PCR, hybridization capture of the mtDNA genome followed by high-throughput sequencing, as well as whole genome shotgun sequencing. In general, morphological misidentifications were common. No gray whale remains were identified among the putative archaeological samples from the Mediterranean, and some paleontological identifications were also revised. ZoomS provided the most cost-effective, but least precise approach for taxonomic identification. mtDNA barcoding was successful for the majority of the samples, though badly degraded remains did not yield DNA fragments of sufficient length for identification. Whole genome shotgun sequencing yielded few or no endogenous sequences, while hybridization capture often provided complete or near complete coverage of the mtDNA genome. This project demonstrated the utility of molecular approaches for identifying cetacean remains, and the importance of accurate faunal identifications in reconstructing paleoenvironments.

Site Ecology and Environment at the Bradford Kaims; Phytoliths and Thin-Sections as Indicators of Burnt Mound Depositional Sequences

Burnt mounds, one of the most numerous and widespread prehistoric monuments in Britain, have now largely been dismissed as unintelligible and dull. This nihilistic appreciation of a deceptively complex monument type stems from the apparent homogeneity and sterility of the mound deposits, which indicate a uniformity of depositional type at the macro-scale. However, new scientific methods applied to these mounds have made it apparent that what is perceived as a boring deposit, actually has a distinct and important series of depositional processes which have led to its accumulation, and post-depositional taphonomies which alter the perceptible record. Combined phytolith and thin-section sampling of burnt mound deposits in Northumberland have led to a number of interesting discoveries, including episodic deposition, concurrent variation in individual depositional events, and the appearance of some intriguing microcomponents within the mound strata.

Scientific approaches, when applied to old theories, can lead to new results. These support a reinterpretation of current typologies, distributions, and functions of burnt mound sites. Despite the complex depositional and post-depositional taphonomies which affect these sites, the data presented in this study has managed to distinguish between individual events of deposition, and episodic accumulations of material, within a conventional 'burnt mound'. Although a pilot study, the presented data has indicated that a re-appraisal of burnt mound classifications is necessary, and also sheds some light upon depositional sequences and the fundamental processes which these ubiquitous prehistoric sites represent.

Other curiosities at the micro-scale include abundances of sponge spicules, diatoms, and dicot phytoliths, indicating that human-environment interactions utilised a diverse range of fuel types, resource uses, and processing patterns. What we thought we knew about burnt mounds and their biographies is now being challenged, and rightly so, by environmental archaeology.

Sweet Chestnut (*Castanea sativa*) in Britain – Using New Techniques and Information to Test its Status as an 'Archaeophyte' of Roman Origin

Rob Jarman¹, Frank M. Chambers¹, Julia Webb¹, Karen Russell²

1. University of Gloucestershire, 2. K Russell Consulting

In Britain, sweet chestnut has long been considered to be a Roman introduction, but only sparse definitive evidence for sweet chestnut has actually been found in Roman contexts, based on conventional pollen and macrophyte analysis, all of which could be derived from imported material.

A new search for evidence of sweet chestnut being cultivated in Britain for any period pre-Norman has been initiated, based on a regional study centred on the Forest of Dean in England. This search is for features that might be associated with a 'chestnut landscape', using evidence from the 'living landscape' as well as from the 'archival landscape'. The 'living chestnut-landscape' includes ancient chestnut trees and coppice stools, which can be dated and their origins mapped from analysis of their DNA and from dendroarchaeology; the 'archival chestnut-landscape' includes place names, customs, written records and new analysis of palaeoenvironmental information.

New approaches in environmental archaeology, using genetics, dendroarchaeology, onomastics and palaeoenvironmental information, are being applied to new and historic data to uncover any 'memory' of chestnut as a food and material resource in Britain's cultural heritage during the past 2000 or more years.

This research is designed to enable a review of the cultural significance of sweet chestnut in England – important given the threat from disease (chestnut blight) to the ancient chestnut trees and woods extant in Britain.

Isotopic Landscapes: Faunal $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values from the Thames Valley

Julie Hamilton, Julia Lee-Thorp, Gary Lock, Robert E.M. Hedges
University of Oxford

Domestic animals were an integral part of the agricultural system introduced into Britain with the Neolithic, and their stable isotope ratios should reflect both their use of the environment they encountered and changes in that environment over time. $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were measured in over 2000 faunal samples from 23 sites in the Upper and Middle Thames Valley, dating from the Neolithic to the Roman period. Variation in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values within and between species, sites, regions and periods was examined in unprecedented detail, and linked to variation in environmental factors, using linear mixed models. Underlying geology, forest clearance, and developing agricultural practices are all reflected in faunal isotope values in the Thames Valley. This work also provides an extensive body of data against which faunal isotope values from other sites can be compared and interpreted.

Changes in agricultural practice may be both cause and effect of environmental change, and looking at changes in domestic animal isotope ratios over time gives us insight into the interactions between people, their animals and their environment at site and landscape scales.

Using Modern Analogue Coleopteran (Beetle) Datasets to Quantify Landscape Cover and Human Activity

*Geoff Hill¹, Nicola J. Whitehouse², Helen M. Roe¹, David N. Smith³,
Ingelise Stuijts⁴,*

1. Queens University Belfast, 2. Plymouth University,
3. University of Birmingham, 4. The Discovery Programme

Over the past decade there has been considerable discussion concerning the use and viability of palaeoenvironmental proxies, particularly pollen, to accurately reflect the structure of vegetation in prehistoric environments. A key aim of environmental archaeology has been to correctly portray landscape change, not only in the landscape cover driven by herbivory that preceded the Neolithisation of the NW European landscape (the so-called 'Vera debate' cf. Whitehouse & Smith, 2010), but also those subsequent, often dramatic, alterations shaped by the pressures of expanding human settlement.

We discuss a method that utilises a modern analogue technique (cf. Smith et al. 2010) to reconstruct past land cover via a refined multi-tier functional group approach with Coleopteran datasets. Sub-fossil beetle assemblages from 19 digitally mapped modern sites with varying forest cover / 'openness' including dense forest, pasture woodland, open parkland and wetland areas from the UK and Estonia, have been sampled, identified and analysed for this study.

Results from the modern analogue datasets indicate that there is a strong relationship between primary functional group proportions and local (within 1000m) landscape vegetation type/cover. Among the sites analysed this is especially strong along a gradient of increasing forest cover. One of the further tiers incorporated in this method allows the assemblages to be scored according to the level of synanthropy it exhibits, permitting comparisons to be made with regard to the degree of human activity present in the surrounding environment. To assess the utility of this modern data for use within environmental archaeology, a range of comparative assemblages derived from archaeological investigation have been selected for presentation.

Developing Understanding of Ephemeral Mesolithic Sites through Geoarchaeological Techniques

Charlotte C.A. Rowley¹, Aimée Little¹, Shannon Croft¹, Emma Tong¹, Charles A.I. French², Chantal Conneller³, Barry Taylor⁴, Nicky Milner¹
1. University of York, 2. University of Cambridge, 3. University of Manchester
4. University of Chester

The site of Flixton Island within the Vale of Pickering, Yorkshire, was situated in the postglacial palaeolake which supported a number of Mesolithic settlements along its shore. At first glance, Flixton Island appears to be a typical, if substantial, Mesolithic lithic scatter found on the dryland of the island with no organic preservation directly associated with the lithics. In order to discover more about the activities that occurred on this site, a program of geochemical and micromorphological analysis has been implemented to complement the lithic analyses. High resolution sampling combined with the application of a variety of analytical techniques for chemical characterisation of the soils is being conducted. By integrating these methods this research is overcoming the issue of intact organic artefacts as a means of developing our understanding of the behaviour of the site's past inhabitants. This methodology holds potential for investigating equally ephemeral sites, with lithic scatters being the most common form of archaeological evidence that we have for this time period.

Exploring Extinction and Community Biodiversity using Niche Models

Nicola J. Whitehouse¹, Georgina Milne², Alison Cameron²
1. Plymouth University, 2. Queens University Belfast

The extinction of species and changing biodiversity of plant and animal communities has long been a preoccupation amongst palaeoecologists and environmental archaeologists studying the Quaternary record. In this paper, we explore new approaches developed in the biological sciences to study patterns of extinction within the fossil record, focusing on saproxylic beetle species. Saproxylic taxa are defined by their dependence upon either living trees, or the dead and dying wood of moribund trees for some part of their life cycle.

Environmental Niche Modelling (ENM) allows researchers to explore how species respond to climate change by building quantitative models linking species distributions to environmental variables. This allows us to assess how changes in environment may be driving ecological processes such as range shifts and extinctions. ENM is widely used by ecologists to assess the impact of future climate change on modern species; it can also be applied to past scenarios to address the same questions in the past and thus obtain greater insights on the longer term behaviour of species.

Here, we focus in particular on species that have become locally extinct during the Quaternary and discuss factors behind species decline. Using niche models, we examine whether niche breadth of selected Holocene taxa can explain species decline and eventual extirpation and their implications towards our understanding of the process of species extinctions. We hypothesise that niche traits influence extinction risk, whereby smaller range sizes (and consequently, niche breadths) are positively correlated with extinction risk, regardless of whether a species is a generalist or a specialist. We highlight the opportunities and challenges provided by the fossil biological proxy record to ask fundamental ecological questions around species migration, adaptation and extinction.

There's more than one way to Skin a Cat: Equifinality and Developer-Funded Archaeology

Suzi Richer¹, Andrew James², Edward Blinkhorn^{3,4}

1. Worcestershire Archive and Archaeology Service, 2. Museum of London Archaeology, 3. Archaeology South-East, 4. University College London

Inspired by Terry's teaching and a question he posed at the AEA Spring Conference, this paper looks at equifinality in the everyday context of commercial archaeology. Equifinality, the idea that there are often different ways to arrive at the same answer, is intrinsic to archaeology, in particular to environmental archaeology and taphonomic studies. The question Terry posed - could perforated and strung shells be used as a something more practical, like an abacus, rather than being purely decorative - was a reminder that we need to constantly challenge our assumptions, or natural interpretations.

Using a range of environmental (and wider) archaeological case studies from the commercial sector, this paper will critically explore a number of questions. Are we offering alternative interpretations for our results? Where we are limiting our explanations - what is constraining us? And more importantly, what enables us to venture to offer different ideas? While there are inevitably considerable restraints (e.g. time, budgets) within the commercial sphere, we ultimately hope to illustrate that although this is an area we perhaps need to be more aware of - our 'skinning techniques' have adapted to our restraints.

Four Decades of Environmental Archaeology Pedagogy in Nigeria.

And so what?

Kingsley Chinedu Daraojimba
University of Ibadan

This paper examines the teaching and study of the subject of Environmental Archaeology (EA) which was introduced into the curriculum of the pioneer Department of Archaeology in Nigeria during the 1973/74 academic session. At present, the University of Ibadan hosts the only existing EA unit in the country. The teaching of EA at Ibadan University underscored the importance of environmental data in archaeological interpretations through an understanding of the ecology of human communities. Since the inception of EA in Nigeria, two major aspects of the subject, palynology and sedimentology, have been taught. Whilst sedimentology and meagre palynology are taught at the undergraduate level, more attention is given to palynology at the postgraduate level. Unfortunately, Zoo-archaeology have been poorly explored due to the fact that there are no trained Zoo-archaeologists in the country. Non-human animal remains from archaeological sites in Nigeria are to an extent not optimally analysed for information due to lack of expertise in this area. This paper therefore brings to light the gains of diversifying the field of environmental archaeology teaching in Nigeria so as to enhance a more balanced and robust understanding of Nigerian archaeological sites.

The Debateable Territory where Geology and Archaeology Meet: Reassessing the early Archaeobotanical Work of Clement Reid and Arthur Lyell at Silchester

Lisa Lodwick
University of Reading

A consideration of the practice of environmental archaeology as field archaeology requires an exploration of the emergence and development of the sub-disciplines over time. Archaeobotany is largely reliant on the sampling

and processing of sediment during archaeological excavations, without which very few plant remains will be recovered by hand-collection. This paper will explore the development of these practices through an examination of the pioneering work of the palaeobotanist and geologist Clement Reid and the antiquarian Arthur Lyell at Silchester, 1899-1909, and evaluate its impact, or lack of, on the development of archaeobotany.

Reid and Lyell undertook an extensive study of waterlogged plant remains from Silchester, retrieved through a programme of sampling and sieving. This took place as an aspect of the Society of Antiquaries campaign of excavations at the Roman town, around 70 years before the wider adoption of these techniques and the “flotation revolution”. The first full examination of the collection of plant remains retrieved by them has revealed that they undertook a systematic and accurate archaeobotanical study. The majority of the plant remains identified have been confirmed, including numerous records of plant foods, and other archaeophytes. The study was though hindered by the lack of understanding of stratigraphy by the excavators, and very brief publication of the resultant data.

The dataset produced did remain important for the understanding of Holocene vegetation through the twentieth century, and provided a key baseline against which archaeobotanical datasets produced in the 1970s could be compared with. Yet, the techniques they had developed did not become integrated into standard field archaeology practice, and the developing field of palaeoenvironmental research moved focus towards palynology. The wider background against which this study took place will be explored, and contrasted with that in which the field of archaeobotany “took-off” in the 1970s.

From Coring Point to Landscape: Using Pollen Dispersal Modelling to Explore Hypotheses of Archaeological Landscape Organisation and Change

M. Jane Bunting
University of Hull

Sediment cores provide reasonably continuous records of the inputs of many environmental proxies, including pollen, from the changing environment around a single coring point, providing the analyst with a spatially weighted average of what is happening in the wider landscape. However, human activity takes place within a structured landscape; for example, a landscape containing 20% tree cover might have several small woodlands with different compositions, a single block of woodland, or as individuals in wood-pasture and scattered throughout an agricultural landscape, and these three options would support different patterns of human activity, provide different resources, and create different kinds of landscape experience which would then shape many facets of the lives and behaviours of the people living there.

Over the last 15 years, pollen analysts have been exploring the use of mathematical models of pollen dispersal and deposition as a means of generating spatially explicit, mapped landscape reconstructions from core records. As personal computers have become more powerful, opportunities to use these models have also expanded, and they are becoming a valuable tool in the environmental archaeologist’s arsenal. This presentation will outline some of the approaches being used, focusing on the Multiple Scenario Approach and a multiple hypothesis testing strategy using the HUMPOL and LandPolFlow software packages developed in Hull, and freely available to the community. Both methods lead to multiple possible landscape reconstructions, which can then be tested against archaeological evidence and against other lines of palaeoecological evidence such as mollusca, insects or vertebrates, or on-site ‘snap-shot’ assemblages.

The Archaeology of Excrement: The Passed and the Present

Andrew K.G. Jones

This paper seeks to demonstrate the scientific importance of multidisciplinary environmental archaeological research by considering the recent history of a single piece of ancient mineralised excrement, the Lloyd's Bank turd. This roughly 1000 year old coprolite, the best preserved human stool found so far in the British Isles, was excavated by the York Archaeological Trust in its first year of work: 1972. Myths and facts surrounding the discovery will be summarised, and the scientific analysis carried out by staff and placement students at the Environmental Archaeology Unit, University of York, will be outlined. The continuing significance of the find will be accessed.

Finally, the paper will reflect on how this object has been curated over the last 40 years. What was once a curious 'environmental sample' languishing in an reused tomato box in a leaking store inhabited by pigeons several years after its excavation, is now permanently on public display in a case of its own in the Jorvik Viking Centre in central York.

Urban Animals: People and Poultry in later Post-Medieval Belfast

B. Tyr Fothergill
University of Leicester

Live animals were a ubiquitous feature of post-medieval urban communities and provided a variety of products (hides, meat, eggs, feathers and dung) to a broad cross-section of society. Poultry (and the "pin money" from egg-selling) were accessible to many people, including those of modest means, and husbandry of these species was often specifically associated with women. A lack of attention to animal husbandry practices within cities, particularly in urban environments outside of London, is at odds with the quotidian presence and widespread nature of these activities. Furthermore, the agrarian historical literature has focused mainly upon rural environments and the wealthier classes of society. The faunal bone assemblage from St Anne's Square, a 0.77 ha 17th-19th-century site in Belfast is one of only a few later post-medieval assemblages from Northern Ireland which has been retained for study. I gathered zooarchaeological data from this assemblage in order to investigate human-animal relationships in an archivally-documented post-medieval working class neighbourhood. In order to contextualise these data, I accessed and investigated historical sources including maps, court records, probate inventories, news sheets and related resources held by the Public Record Office of Northern Ireland. By combining metrical and palaeopathological data obtained from the St Anne's Square avian bone assemblage with these local documentary sources, I will discuss urban poultry-keeping practices, illuminate aspects of quotidian animal-human relationships and shed light upon the roles and management of poultry from the 18th to 19th century in Belfast and its environs.

The Blood of the Beasts: The Social Taphonomy of Cattle Bones in a Mediaeval City

Lee G. Broderick
University of York

The slaughter and butchering of animals in Mediaeval cities was a violent feature of everyday life, contrasting with but underpinning the more sedate pleasures and skills of food and craft. It has long been recognised that animal remains from urban sites can inform us of these activities in the past but identifying them has generally relied upon recognising distinct archaeological features and particular types of assemblages.

By adopting biographical theory, in particular *chaîne opératoire*, and incorporating it into taphonomic enquiry, it is possible to shed light on the complex network of social organisation and industrial activities that helped

form an assemblage. Importantly, this means that pit and other deposits that are unrelated to any activity areas or buildings and which are poorly stratified or highly heterogeneous can be used to answer more questions than simple site-wide species or body-part proportional representation lists. This presentation revisits some of the Mediaeval assemblages from York in order to develop our understanding of life in the city through its zooarchaeology.

Medieval Towns under the Microscope: Integrating Micromorphology, MicroXRF and Phytoliths

Barbora Wouters^{1,2}, Yannick Devos³, Karen Milek², Luc Vrydaghs³

1. Vrije Universiteit Brussel, 2. University of Aberdeen,

3. Université Libre de Bruxelles

Micromorphology, the study of undisturbed soils and sediments under the microscope, is an effective method for the geoarchaeological research of complex sites. This talk presents an overview of how the technique can contribute to the study of (early) medieval towns, demonstrated by several case studies from Northwestern Europe. The types of questions that can be tackled using this method range from the basic understanding of stratigraphy of both microstratified levels and thick homogeneous units such as “dark earths”, formation processes and environmental context to the identification of different activities.

A valuable approach to refine the results from micromorphological analysis even further is to complement this technique with micro X-ray fluorescence spectrometry (μ XRF) and phytolith analysis. The systematic scanning of block samples with μ XRF helps to understand specific issues that concern elemental composition of the samples, such as the identification of on-site metalworking, the identification of components and their provenance. Because the same polyester resin-impregnated blocks are used for the micromorphological thin sections as for the μ XRF analysis, the results can be correlated and chemical elements pinpointed exactly. By combining both the visual and elemental data we can take our interpretations further: not only is it possible to identify objects and activities more precisely, one can also see and interpret them in relation to each other within their original stratigraphy. Phytolith analysis, the study of inorganic bodies of plant origin, provides information on the botanical component and its taphonomy, particularly in contexts where pollen and macrobotanical remains are poorly preserved.

The potential of this integrated approach is illustrated with examples from Northwestern town sites such as Kaupang (Norway), Haithabu (Germany), Antwerp (Belgium), Brussels (Belgium), and Lier (Belgium).

Herd Demographics in Zooarchaeology: A Critical, Simulation-Based Assessment of the Viability of the Standard Mandibular Approach

David Orton¹, Jesse Wolfhagen²

1. University of York, 2. Stony Brook University

Zooarchaeological age-at-death analyses are used to address a wide range of issues, from domestication through to trade and urban provisioning. In particular, however, they have been widely applied to understanding prehistoric herd management, typically by comparison to a range of published models representing idealised kill-off strategies.

Amongst numerous theoretical and technical problems with this approach, one of the most pervasive and yet poorly examined issues is that of sample size. Put simply, we have very little idea how large a sample is required in order consistently to discriminate between even idealised theoretical herding strategies.

Here, we test the effect of sample size on the ability to distinguish consistently between four popular mortality models under ideal conditions. We simulate death assemblages of varying sample size from several models developed by Payne, Redding, and Vigne & Helmer that have been widely used in the context of analysing prehistoric herding. By increasing sample size incrementally and repeating each simulation 2000 times at each increment, we visualise confidence intervals around each curve and demonstrate the extent of overlap at different sample sizes. Applying formal significance tests to each simulation run, we then plot the relationship between sample size and the rate of false negatives (type 2 errors).

The results demonstrate that many of the assemblages upon which interpretations have been based, and around which arguments have revolved, are not in fact sufficient to distinguish these models even under the most optimistic of assumptions.

Super Furry Animals: Locating Foxes and Badgers in Anglo-Saxon Life

Kristopher Poole
University of Sheffield

Anglo-Saxon England had a diversity of wild animals, yet the majority of studies to date have tended to focus on a select group of species. These include those that are the most frequent in bone assemblages, such as red and roe deer, but also those that are rare in Anglo-Saxon period bone assemblages and subsequently became extinct in Britain, such as the wolf and beaver. As research has shown, the roles of these species in Anglo-Saxon England differed considerably, itself no surprise, given that the term 'wild' actually covers a wide range of species and diverse range of relationships (O'Connor 1997: 152). Yet human relationships with two of these species, the red fox (*Vulpes vulpes*) and the badger (*Meles meles*) have to date received relatively little attention in research. This lack of study is despite the fact that both would have been present across much of the British Isles throughout the fifth to eleventh centuries. This paper utilises zooarchaeological data, documentary sources and place-name evidence to explore the roles of these animals and how they were perceived in this period. Despite their low zooarchaeological representation, the patterning of their remains on settlements indicates that they were engaged with (or not) differently between social levels. Moreover, place-name data demonstrate a keen awareness of the behaviour of both species and the close connection between humans, animals and local landscapes. The contrast between zooarchaeological and place-name data highlight the potential greater importance, in terms of daily experience, of these species when alive than dead. It also demonstrates the importance of adopting integrative approaches to studying human-animal relations in the past.

Zooarchaeology of Emotion and Grief

James Morris
University of Central Lancashire

The inside photograph at the beginning of Terry's 'The Archaeology of Animal Bones' book, shows an Anglo-Saxon horse burial under excavation. The caption suggests this deliberate burial shows what the horse meant to the people, but what did it mean? The meanings humans attach to animal burials is polythematic in nature and are much more complex than the simplistic ritual/waste dichotomies we often fall into. These kinds of deposits could also be an important component of social memory, with the actions forming part of a major event in people's lives. As archaeologists we can investigate material aspects of such events, but a major factor we fail to consider is emotion. Many may view emotion as unrecoverable, not suitable for objective analysis, but there is a growing trend within archaeology to consider emotion, especially within prehistoric archaeology. As Peterson (2013) has rightly pointed out for funerary archaeology, whilst the processes are well understood, the emotional damage of grief and loss are often omitted.

Is it therefore possible to explore emotion, and in particular grief, from the zooarchaeological record? Humans grieve for animals, many modern day pets are subject to ceremonies we undertake on our own dead, highlighting the emotional connection many feel. But is this just part of our modern day mind-set? In exploring a zooarchaeology of emotion using animal burials, a possible approach is to consider points of contact between humans and the animal corpse. For example does the careful manipulation of a cat inside a tile cist at Silchester, or the placement of a dog inside an Iron Age pit, reflect emotion? Is it possible some of the animal burials we see were driven by emotion and mourning?

Nest Egg: The Role of Eggs in Reconstructing Past Avian-Human Relationships

Julia Best
Bournemouth University

Eggs form an important part of avian-human interactions both today and in the past. They can be sourced from wild and domestic birds, but due to the creation of extended laying times in several domesticates, egg acquisition is frequently weighted towards poultry. Ducks, geese and other birds can all be kept for their eggs, but the chicken plays perhaps the most important role. As such, this work focuses on chickens but is contextualised within the wider body of archaeoavian evidence. Such examination allows fuller understanding of past avian-human relationships in the context of diet, economy, society, and (particularly for wild birds) the environmental and seasonal aspects of their relationship. This paper investigates egg use in the past by combining zooarchaeological and scientific analysis of physical eggshell remains from archaeological sites with evidence from documentary sources and material culture. Identification of eggshell to species via ZooMS (Zooarchaeology by Mass Spectrometry) and SEM (Scanning Electron Microscope), and the exploration of developmental stage via microscopy can be used to examine husbandry practices, fowling, and resource use in the past by informing on meat and egg production. Documentary sources include letters and orders (e.g. the Vindolanda tablets), and agricultural guides detailing husbandry and produce (such as Columella's *Res rustica*). Using case studies from Roman and Medieval Britain this paper demonstrates how multidisciplinary integration of eggshell analysis with other lines of evidence can offer new insights into avian-human relationships in the past.

Diverse Ritual Practices in two Late Roman Landscapes, or, Where's My Cow?

Clare Rainsford¹, David Roberts²
1. University of Bradford, 2. Historic England

Animals played a critical role in Romano-British ritual and religious practices, with distinctive assemblages of faunal remains found from burials, shrine and temple sites, as well as foundation deposits from settlements. However, there is considerable heterogeneity in these practices, reflecting diversity in belief and in broader animal-human relations. This paper will explore one example of this using evidence from recent excavations at two late Roman shrines in south-west Wiltshire.

Despite the two sites being in relatively close proximity and contemporary with each other, ritual activity in these places demonstrates startlingly contrasting characteristics, in terms of architecture, landscape and material culture. This is reflected and expressed in the zooarchaeological assemblages from these sites, which demonstrate different and distinctive "ritual" features, from the sacrificing of lambs at one site to a near-complete absence of cattle at the other. Contextualisation within the broader suite of everyday animal-human-landscape interactions is key to understanding diverse expressions of belief, emotion, power and wealth that are

evidenced in these ritual settings. This contribution will elucidate the roles of key species in the everyday landscape and in ritual practice at the two sites. This process of discussion will explore wider rural landscape practices including pastoralism, arable agriculture, animal husbandry and industry. A detailed and integrated diachronic approach has been taken in analysing these sites, and despite the late Roman date of these shrines, it can be suggested that the landscape roots of these practices extend into the earlier Roman period. Understanding the bioarchaeology of these “ritual” sites in their wider context may provide a window onto long-term social practice in the landscape.

Human-Animal Relations in Iron Age Wessex: A Histological Study of Pit Deposits from the Danebury Environs, Hampshire, UK

Richard Madgwick¹, Tom Booth²

1. Cardiff University, 2. Natural History Museum

The recovery of unusual configurations of human and animal remains from atypical contexts is a persistent feature of the archaeological record in Iron Age Southern Britain. Human remains are often deposited on settlement sites as disarticulated fragments, articulated limbs or skeletons, frequently in storage pits or ditches. Faunal material is also regularly recovered from these features in configurations uncharacteristic of domestic refuse, including skulls, articulating limbs and complete skeletons. The practices responsible for these deposits have long been debated, with human remains variously interpreted as evidence for excarnation, exhumation, cannibalism, disturbance and curation. Faunal deposits have been explained as relating to sacrifice, feasting, diseased animals and fertility rituals. Research by J.D. Hill and James Morris amongst others has shed considerable light on patterns of deposition. However, equifinality remains a substantial hurdle to interpretation, in many instances supporting data is lacking and reconstructing precise practices remains problematic.

This research explores the potential of using microscopic methods of taphonomic analysis in combination with macroscopic taphonomic indices for providing greater detail on the treatment of human and animal remains in Iron Age Wessex. The approach focuses on taphonomic modifications to bone microstructure (histology) that result from distinctive pathways in the depositional histories of osseous remains. This approach is tested on human and animal bones from two sites: Danebury and Suddern Farm, in Hampshire, central southern Britain. Results demonstrate that diverse modes of treatment were practised and that different configurations of remains were subject to prescribed, varied treatment, rather than resulting from different stages of the same process. These data provide new insights into human-animal relations and their treatment in death in Iron Age Southern Britain.

Variation of *Apodemus* Mandibular Morphology During the Holocene: Functional Implications

Elizabeth Kerr¹, Anne Tresset¹, Anthony Herrel^{1,2}, Raphaël Cornette¹

1. Museum National d'Histoire Naturelle, 2. Ghent University

Human activity has altered the ecology and landscape considerably in Western Europe during the Holocene, primarily through the introduction of agriculture. This has resulted in changes in biodiversity, however there has been little investigation into possible concomitant evolutionary changes in native species. The wood mouse, *Apodemus sylvaticus*, was present Western Europe prior to the introduction of agriculture, and due to its

anthropogenic tendency has not declined dramatically and is currently a common species. Micro-mammal species, which have short generation periods, can evolve rapidly. The morphology of the mandible has also been shown to be highly evolutionarily responsive to functional demands associated with ecological changes, therefore providing a good model for investigating these patterns. A biomechanical model constructed using extant data is used to test the changes in mandibular shape of *Apodemus* from archaeological material across the Holocene in Western Europe, primarily France. We predict either a functional mandibular change, or non-functional changes reflecting random drift over time, or alternatively that the inherent versatility in *Apodemus* feeding biomechanics has allowed it to persist in a drastically altered ecology. These results will provide important data on the long-term human effects on the evolution of organisms in altered ecosystems. Functional changes in species may indicate shifts in ecological niche, and future studies may reveal how species interactions could therefore change over time. These perspectives could permit predictions on how human activity will continue to alter and affect micro-mammal phenotypes and ecological systems.