



ROYAL ARCHAEOLOGICAL INSTITUTE

SCIENCE IN ARCHAEOLOGY

Annual Conference 2014
17 – 19 October

Norcroft Centre
University of Bradford

In association with



Venue **Division of Archaeological Sciences, Phoenix SW Building, University of Bradford (Friday)** and Norcroft Centre, University of Bradford (Saturday and Sunday)

Friday 17th October

12.00 Registration, Coffee, Welcome & Introduction
13.30 Visit to and tour of Bradford Cathedral
15.00 Guided tour of Bradford City Hall and reception from Bradford's Lord Mayor
18.00 Prof. Carl Heron (University of Bradford). Archaeological Sciences – The last 40 years

Saturday 18th October

09.30 Prof. Paul Pettit (University of Durham). Early Prehistory – The last 40 years
10.15 Adrian Evans (University of Bradford). The Fragmented Heritage Project
10.30 Randolph Donahue (University of Bradford). Hunter-gatherer social organisation during the Late Glacial in Northwest Europe
10.45 Discussion
11.00 Coffee
11.30 Prof. Mike Parker Pearson (University College London). The Neolithic and Bronze Age – The last 40 years
12.15 Sonia O'Connor (University of Bradford). Whale bone and ivory Bronze Age dagger pommels
12.30 Alex Gibson (University of Bradford). Wharfedale henges
12.45 Discussion
13.00 Lunch
14.00 Prof. Tim Champion (University of Southampton). Later Prehistory – The last 40 years
14.45 Emily Fioccaprile (University of Bradford). Recent geophysics and topographic survey at Huggate Dykes
15.00 Lindsey Büster (University of Bradford). Lighting up the dark: 3D laser-scanning of the Sculptor's Cave, NE Scotland
15.15 Discussion
15.30 Tea
16.00 Prof. Gordon Cook (SUERC). Radiocarbon Dating – The last 40 years
16.45 Cathy Batt (University of Bradford). Magnetic moments and hot pots-developments in dating fired material
17.00 Zoe Outram (English Heritage). Dating Vikings
17.15 Discussion
17.40 - 19.00 Wine reception

Sunday 19th October

- 09.30 Prof. Vince Gaffney (University of Birmingham). Remote Sensing – The last 40 years
- 10.15 Chris Gaffney (University of Bradford). Not digging up the past
- 10.30 Peter Turner (University of Bradford). Beyond anomalies: advanced geophysical and geochemical techniques for studying cultural patterns in the European Iron-Age
- 10.45 Discussion
- 11.00 Coffee
- 11.30 Prof. Ian Freestone (University College London). Materials Science – The last 40 years
- 12.15 Ben Stern (University of Bradford). Studying organic residues
- 12.30 Rhea Brettell (University of Bradford). Choicest unguents: resins and mortuary rites in Roman Britain
- 12.45 Discussion
- 13.00 Lunch
- 14.00 Prof. Charlotte Roberts (University of Durham). Human Remains – The last 40 years
- 14.45 Andy Wilson (University of Bradford). Recent work on Andean mummies
- 15.00 Jo Buckberry and Andrew Wilson (University of Bradford). Digitised diseases
- 15.15 Discussion
- 15.30 Tea
- 16.00 Prof. Terry O'Connor (University of York). Animal Remains – The last 40 years
- 16.45 Julie Bond (University of Bradford). Being human; animals, identity and transformation in the first millennium A.D.
- 17.00 Clare Rainsford (University of Bradford). Taboo or Not Taboo? Fish, wealth and landscape in Iron Age Britain
- 17.15 Discussion

The Cheney Bursary Fund, which sponsors student delegates, has been augmented by a generous donation from RAI member, Beryl Schumer.

Abstracts

Prof. Paul Pettit (University of Durham)

Early Prehistory – The last 40 years

Over the last 40 years our understanding of 6 million years of human evolution has been transformed by a wealth of fieldwork in Africa, Asia and Europe that has yielded the physical remains and archaeology pertaining to at least 4 genera and 20 species of hominin ('humans' or erect walking primates), of which three survived as late as 40,000 years ago. A major paradigm shift occurred in the 1980s, focussing research away from early hominin evolution in Africa and controversies over emerging dating methods applicable to the Myr timescale, to the indigenous Eurasian Neanderthals and the African emergence and Eurasian dispersal of *Homo sapiens*. This latter endeavour, with a pedigree approaching 30 years in length, has seen some of the most profound developments in archaeological and quaternary science, including the development of precision reconstruction of climate change that forms the backdrop to all human evolution and dispersal; computer tomographic reconstruction of hominin developmental anatomy; sequencing of ancient DNA including the Neanderthal genome; isotopic and other reconstruction of hominin diets; trace elemental reconstruction of hominin landscape use; increased accuracy and precision of dating through a number of methods; and the application of sophisticated survey and recording methods to landscapes, sites and archaeological remains of art and other behavioural traces. I will survey these developments here, showing not only how these developments have transformed our picture of early human prehistory, but how controversy is never far below the surface: from pigs and the 'KBS Tuff controversy' of the 1970s to Bayesian modelling of dates in the present, scientific techniques for early prehistory form the platform of debate for modern palaeoanthropology.

Randolph Donahue (University of Bradford)

Hunter-gatherer social organisation during the Late Glacial in Northwest Europe An introduction into the power of Fragmented Heritage

The aim of this study is to illustrate the potential power of Fragmented Heritage when applied to Palaeolithic sites in Northwest Europe. Here, microwear analysis, in combination with refitting and lithic reduction, is applied to reconstruct the function and social organisation at the Late Glacial site of Trollesgave, Denmark. Analyses of the flint knapping and the spatial distribution of its products reveal the traces of at least three individuals: expert, medium competent, and inexperienced. Based on the quality of craftsmanship and the aberrant habits of disposing their products of the latter, there is evidence for one and possibly two children. As with Bromme Culture sites in general, the assemblage consists of primarily three types of tools. There is a strong association between these types and their use: end scrapers for dry hide scraping; burins for working hard material, primarily bone; and tanged points primarily for projectile tips. Nearly all divergence from this pattern can be referred to the activities of the children. The site appears to be occupied by a single family hunting (and fishing) unit and provides hypotheses about the social organisation of other kinds of Bromme Culture sites in northern Europe.

Prof. Mike Parker Pearson (University College London)

The Neolithic and Bronze Age – The last 40 years

In 1974 I was applying to do a degree in archaeology at university. I'd hated physics and chemistry at school and given them up as soon as possible. Biology was only slightly more tolerable. As far as I was concerned, the bright future for archaeology lay with applying the method and theory of the New Geography, as pioneered by David Clarke's *Analytical Archaeology* and *Models in Archaeology*. The 'hard' sciences were best left to boffins who could tell us what artefacts were made out of, or how radiocarbon-dating could provide chronologies for our sites, and so on. I was lucky to go to a university department whose staff revealed how science of all sorts supported the quest for knowledge about prehistory and, more importantly, showed me that science wasn't as frighteningly difficult as my school teachers had unintendedly led me to believe. Looking back, many of the science-aided breakthroughs in prehistory in this last decade were only wished for in the 1970s or were not even imaginable. Other successes have come from improving upon long-established techniques. In 40 years, archaeology has flourished and diversified so that this wide range of expertise is increasingly incorporated into multi-disciplinary team-led projects asking big questions of prehistory. Unlike the study of geography, we are more fully integrated as 'science' and 'humanities' than ever before.

Sonia O'Connor (University of Bradford)

Whale bone and ivory Bronze Age dagger pommels

The cultural significance of cetaceans in prehistory is difficult to gauge particularly as most of the resources they provide are highly biodegradable and do not survive to be recovered by excavation. Recent developments in the identification of animal hard tissues is providing evidence that the use of cetacean bone and ivory was not entirely dictated by local availability or the need for large pieces of raw materials but was also driven by less tangible but persistent factors.

Alex Gibson (University of Bradford)

Wharfedale henges

Until recently, the small penannular enclosure at Yarnbury, near Grassington, was the only contender for henge monuments in Wharfedale. Like henges, it has an internal ditch and external bank. Unlike henges it sits in apparent isolation on a watershed spur between the main valley of the Wharfe and one of its tributaries, the Hebden Beck. In 2007, aerial photographs located a large double ditched enclosure at nearby Threshfield and Lidar data made available to the YDNP located a possible double-entranced earthwork a few metres to the SW. A collaborative project between the Universities of Vienna and Bradford, funded by the British Academy, has applied landscape magnetometry to these sites in an attempt to locate associated monuments and shed light on any perceived building sequences within the monuments. The results have proved surprising.

Prof. Tim Champion (University of Southampton)

Later Prehistory – The last 40 years

The impact of archaeological science on our understanding of the later prehistory of Britain and Ireland has been variable. The availability in some regions of an apparently reliable ceramic-based chronology, coupled with the problems of interpretation at the time of the plateau in the calibration curve, has worked against the widespread application of radiocarbon dating, though its impact has been much greater in other areas, most notably in Ireland, where it has led to the discovery of the Iron Age. Targeted projects, for instance on Celtic art, are beginning to have a significant impact. The widespread lack of recoverable burial evidence has hindered research on human remains, though important work has been done on the limited regional assemblages of inhumations that are available. Much of the most informative scientific research has been in the fields of environmental archaeology and materials science. Study of animal bones and plant remains, where conditions allow, has led to a better picture of the regional variability in agricultural practice. Petrological study of pottery and stone, especially querns, has transformed our knowledge of the production and distribution of these artefacts, and has contributed to our knowledge of the evolution of more complex economic systems in the course of the Iron Age.

Emily Fiocoprile (University of Bradford)

The life and death of Huggate Dykes: the linear earthwork landscapes of the Yorkshire Wolds

During the first millennium BC, the people of the Yorkshire Wolds began carving up their world with enclosures and linear earthworks. Huggate Dykes, first excavated by JR Mortimer in the 19th century, is one of the best-preserved stretches of linear earthworks on the Wolds, and yet it is often overlooked in studies of the British Iron Age. The monument spans a ridge of high ground between two valleys and consists of seven sinuous banks and ditches at its most elaborate point. Drawing on recent geophysical fieldwork and employing a biographical approach, this paper traces the life of Huggate Dykes through several phases of construction and modification. It explores how the site developed in a landscape that was already alive with myths and meaning, and proposes how the site controlled the ways in which prehistoric people interacted with the land. Finally, the paper asks when and why Huggate Dykes ceased to hold special meaning for the people of the Yorkshire Wolds—essentially, when it died—and why, despite its value to our understanding of British prehistory, it has been eclipsed by nearby sites such as Wetwang-Garton Slack.

Lindsey Büster (University of Bradford)

Lighting up the dark: 3D laser-scanning of the Sculptor's Cave, NE Scotland

The Sculptor's Cave, which derives its name from the Pictish symbols carved on its walls, yielded one of the most significant assemblages of Late Bronze Age metalwork in Scotland, together with coins and other artefacts from the Roman Iron Age. Although the artefactual material is exceptionally significant, perhaps the real importance of the cave derives from the corpus of human remains. These have revealed that the cave was no ordinary domestic site,

but that it witnessed at least two distinct and unusual mortuary rites, centred on the apparent ritual killing and disposal of individuals: the display of predominantly juvenile (and possibly adorned) skulls in the Late Bronze Age, and the decapitation of individuals in the Roman Iron Age. The association of human remains with depositions of metalwork, including coins, finds parallel internationally at sites like the Trou de Han and La Galerie des Petites Fontaines in the Belgian Ardennes, and other north-west European cave systems. New analysis of old excavations, and particularly the use of modern technological and analytical techniques (including laser-scanning and acoustic modelling), is revealing more about not only the individuals involved but about the arena in which these highly ritualised activities took place. This paper will discuss the results of recent fieldwork at the Sculptor's Cave (including laser-scanning of the cave itself and detailed structured light scanning of the Pictish carvings), and how these are aiding our understanding of the highly ritualised activities which were taking place at this enigmatic site.

Prof. Gordon Cook (SUERC)

Radiocarbon Dating – The last 40 years

The radiocarbon (^{14}C) dating technique was developed in the late 1940s/early 1950s at the University of Chicago by a team of scientists led by the late Willard Libby, for which he received the Nobel Prize in Chemistry in 1960: *"for his method to use Carbon-14 for age determinations in archaeology, geology, geophysics, and other branches of science."* One scientist described his research in the following glowing terms: *"Seldom has a single discovery in chemistry had such an impact on the thinking of so many fields of human endeavour. Seldom has a single discovery generated such wide public interest."* Since the early 1950s the technique has advanced out of all recognition. The original screen wall measurement system required about 8.5 grams of carbon per sample and many hours of measurement time, while low counting efficiency meant that the upper dating limit was less than 25,000 years BP and the associated counting statistics translated to uncertainty ranges of 200 to 300 years on samples up to 5,000 years old. Today, modern accelerator mass spectrometers (AMS) require about 1 milligram of carbon and can achieve an upper dating limit of around 50,000 years BP, while less than an hour of measurement time will result in uncertainties of 25 to 35 years for samples up to 10,000 years old. These advances will be discussed along with the many new applications within archaeology that have resulted from the improvements in sample measurement time and the reduction in the required sample size.

Cathy Batt (University of Bradford) with contributions from Zoe Outram (English Heritage) and Sarah Jane Clelland (University of Manchester)

Magnetic moments and hot pots – developments in dating fired material

Interpretation of the ceramic evidence forms a vital part of understanding of many archaeological sites. However, although fired materials and structures are often abundant and survive well, the scientific methods available to date them directly are limited. This paper will provide an update of recent developments in two such potential methods: archaeomagnetic studies and rehydroxylation dating. The paper will discuss the most recent

research, the successes and the limitations; concluding with an evaluation of the future potential of these methods.

Zoe Outram (English Heritage) with contributions from C.M. Batt, G. Swindles, J.M. Bond, M.J. Church and G.T. Cook

Dating Vikings

The timing of a Norse settlement is crucial for understanding the archaeology of many sites across the North Atlantic region and this study compares three absolute dating techniques (AMS radiocarbon, tephrochronology and archaeomagnetism) applied to the site of the Upper House, Underhoull, Unst, Shetland Isles, excavated as part of the Viking Unst Project by the University of Bradford. This study focused on the island of Unst as it has been suggested that it may have played an important role in the westward expansion of the Viking/Norse populations, acting as a staging post between Norway, Britain and the lands further west. Dates were produced following the excavation of a longhouse at Underhoull, focusing on hearths, activity surfaces within the structure, and an area of peat accumulation adjacent to the structure. Stratigraphic evidence was used to assess sequences of dates within a Bayesian framework, constraining the chronology for the site as well as providing modelled estimates for key events in the life of the site, namely the use, modification and abandonment of the settlement.

Prof. Vince Gaffney (University of Birmingham)

Remote Sensing – The last 40 years

“During the last 60 years, a number of highly ingenious methods for detecting and mapping otherwise invisible archaeological sites have been developed... Almost all the techniques were initially derived from methods used in geological geophysical prospecting and conventional aerial survey, but they have grown into a separate discipline with its own specialities”

Scollar I. et al. (1990) *Archaeological Prospecting and Remote Sensing*. CUP, page 2

Although Scollar et al.’s masterly work on remote sensing drew on a tradition of archaeological prospection stretching over six decades, the 24 years following this publication has seen prospection technologies available to archaeology develop from disparate tools generally used, if available, for site investigation to a suite of technologies capable of wide application and frequently used for larger scale exploration. Recent change, palpably evident in the enhanced scale and resolution of collection, capacity for storage and sophistication of analysis, places archaeological prospection at a new point of departure. For some strategic research projects prospection data “is” the archaeology, and its significance is increasingly determined through integration with broader archaeological agendas rather than simply as a route to find “where things are”. Indeed, the point may have been reached rather than being a “handmaiden” of archaeology archaeological prospection is achieving a formative position which, through integration with novel mapping technologies, may drive the development of archaeology in entirely new directions. This paper will review such change and consider where future development may take place.

Chris Gaffney (University of Bradford)

Not digging up the past

Geophysical prospecting techniques were originally applied in archaeological projects in order to locate the ‘best’ place to excavate or to provide a previous excavation a ‘context’. While practitioners have often suggested that the geophysical sensor does not negate the use of a spade, it is true that over the last decade or so has seen unprecedented technological and computational changes in ground-based remote sensing. In this paper recent research undertaken at the University of Bradford will be used to consider whether archaeologists can look forward to not digging up the past.

Peter Turner (University of Bradford)

Beyond anomalies: advanced geophysical and geochemical techniques for studying cultural patterns in the European Iron-Age

The ENTRANS project will examine the nature and impact of cultural encounters in the highly fluid social world of the European Iron Age. Focussing on encounters between Mediterranean and temperate European societies, the project examines zones of primary contact where material culture, bodily treatments and patterns of landscape inhabitation provide new insights into the construction and negotiation of identity. The East Alpine region, including inter alia parts of northern Italy, Slovenia, Croatia and Austria, formed a major locus for cultural encounters throughout much of pre- and proto-history. Building upon on existing fieldwork, part of this project involves the use of both established and novel geophysical and geochemical techniques alongside LiDAR survey to understand settlement patterns and metalworking behaviour at a number of nodal sites in the region. These techniques hold out the possibility of developing a detailed understanding of landscape use across entire sites, providing crucial information for understanding local identities. This paper presents a discussion of both previous work in the region by project partners, preliminary results from a number of sites, and a road map indicating the enhanced deliverables that result from the use of novel in this research area.

Prof. Ian Freestone (University College London)

Materials Science – The last 40 years

Many of the questions asked of archaeological materials by scientists such as Faraday in the early nineteenth century were still with us a hundred years later, and remain of interest today. Most would probably agree, however, that we can answer them a good deal more robustly than we could even 40 years ago, and this trend is likely to continue. New techniques have allowed us to do new things on more samples, not only at lower cost in financial terms but also at lower cost to the objects, in that samples are often much smaller. Techniques based upon mass spectrometry such as the analysis of lead isotopes and the analysis of lipids have revolutionised our expectations of the information we can hope to obtain. Many challenges remain, not least the “democratisation” offered by portable X-ray fluorescence, a relatively low-cost technique with enormous potential but which also offers limitless possibilities for the generation of meaningless data.

Rhea Brettell (University of Bradford)

Choicest unguents: resins and mortuary rites in Roman Britain

For centuries there has been speculation regarding the use of aromatic resinous substances in Roman mortuary contexts. Details gleaned from classical literature indicate that they played a significant role in the treatment of the body and as offerings made at the tomb. Nonetheless, outside of Egypt where research has shown that plant exudates were key components of the mummification process, they have rarely been identified in the burial record. Using gas chromatography-mass spectrometry and the well-attested biomarker approach, organic residues from a range of burial contexts were analyzed. The results provided the first direct chemical evidence for the use of resins in Roman Britain. Exudates from three different plant families were identified: coniferous Pinaceae resins, Mediterranean *Pistacia* spp. resins (mastic/terebinth) and exotic *Boswellia* spp. gum-resins (frankincense/olibanum) from southern Arabia or beyond. The individuals accorded this rite had all been interred with a package of procedures more elaborate than the norm. The recovery of these molecular traces illuminates the multiplicity of roles played by resinous substances in Roman mortuary practices. Their material properties speak to both the biological reality of the decomposing body and to the individual as a social being. These findings also throw new light on the relationship between the remote province of *Britannia* and the remainder of the Roman Empire.

Prof. Charlotte Roberts (University of Durham)

Human Remains – The last 40 years

The study of archaeological human remains (bioarchaeology) has had a lengthy history, including in the UK, and has encompassed the most ancient early hominine remains to those excavated from post-medieval contexts, especially in recent years. However, it is argued that it is perhaps only in the last 30-40 years where bioarchaeology has come to the fore, alongside provisions for professional training and the development of methods that have very much enriched our understanding of our ancestors through their remains. This paper will attempt to provide a broad brush survey of bioarchaeology's development. While focusing on the UK, it will extend its discussion, as appropriate, to other parts of the world, and concentrate on five areas; infrastructure, professional training, recording standards, ethical concerns, and analytical methods. In doing so, it will discuss relevant key milestones. The paper will conclude with some thoughts on future developments, strengths and weaknesses, and opportunities and obstacles.

Jo Buckberry and Andrew Wilson (University of Bradford) with Chris Gaffney, Hassan Ugail, Natasha Powers, Carina Phillips, Keith Manchester, Andrew Holland, Tom Sparrow, Rebecca Storm, Emma Brown, Don Walker, Mike Henderson, Alan Ogden, Anthea Boylston, Gordon Le Roux, David Keenan, Pawel Eliaz, and David Connah

Digitised Diseases: a key resource for human osteology and palaeopathology

The Digitised Diseases project is a major resource supported by funds from Jisc, the University of Bradford and Bradford Visualisation. The multi-disciplinary team involving

project partners MOLA (Museum of London Archaeology) and the Royal College of Surgeons of England has undertaken a programme of mass digitisation of pathological type specimens from world-renowned archaeological, historic and medical collections at the University of Bradford, in London and York. Skeletal elements were digitised using 3D laser scanning. 3D scan data was augmented with photo-realistic ‘texturing’ to enable virtual examination of specimens, many of which are too fragile to submit to regular handling. The models are supported by detailed palaeopathological descriptions and clinical synopses. Where appropriate we have also included CT and radiographic information, together with other visual materials to aid interpretation and understanding of chronic palaeopathological conditions affecting the skeleton. We envisage that our dynamic 3D visual resource will make type-specimens far more widely available to a diverse user community and will have broad impact amongst osteologists, palaeopathologists, clinicians, medical trainees, medical historians, archaeologists, as well as enriching the wider public understanding of science. The 3D models are freely downloadable and can be used for teaching and research. This paper will discuss the development of the resource and will indicate how it will enhance teaching of human osteoarchaeology and palaeopathology.

Prof. Terry O’Connor (University of York)

Animal Remains – The last 40 years

Zooarchaeology – the study of animal remains in archaeology – has widened and deepened to a remarkable degree over the last four decades. In part this has been through the development of wholly new techniques of investigation that allow us to address questions that would have seemed unanswerable just a few years ago. Here the challenge is to frame apposite questions, to be led by the research not the techniques. In part, too, we have developed more rigorous and subtle ways of undertaking familiar investigative procedures, better ways of doing the same things. Perhaps most important has been the evolution of our understanding of the relationship between past animals and their people, bringing much richer and more complex models of behavioural co-evolution within which to frame the research questions.

Clare Rainsford (University of Bradford)

Taboo or Not Taboo? Fish, wealth and landscape in Iron Age Britain

There has been substantial and convincing exploration in the archaeological literature of the apparent avoidance of fish consumption during the British Iron Age, exemplified by the work of Dobney & Ervynck (2007). The practice of fish avoidance has been explained using cultural and ideological factors, particularly the ritual status of watery places in later prehistoric worldviews and practices relating to disposal of the dead. In this paper, we discuss the evidence for the extent and nature of fish avoidance in the Iron Age, and elaborate a more holistic, contextualised understanding of this social consumption practice. The Iron Age saw a major increase in social stratification, agricultural intensity and exploitation of animal wealth by elite groups, as well as increasing avoidance of or ritual behaviour towards “wild” animals (Hill 1995). Changes in landscape use in particular suggest a greater emphasis on control of animals and agricultural surplus in the mid to late Iron Age. With domestic animals and arable crops used to materialise a greater range of relationships within and between communities, fish may have become insignificant or undesirable in terms of consumption.

We suggest that although the cultural and environmental reasons for the practice of fish avoidance were complex, equally as important are the wider societal developments of terrestrial landscape, society and belief, and little understanding of this practice can be gained without consideration of the wider cultural context and consumption system within which it is situated.

Dobney, K. and Ervynck, A. 2007. To fish or not to fish? Evidence for the possible avoidance of fish consumption during the Iron Age around the North Sea. In Haselgrove, C. and Moore, T. (eds), *The Later Iron Age in Britain and Beyond*, 403—418. Oxford: Oxbow Books.

Hill, J.D. 1995. *Ritual and Rubbish in the Iron Age of Wessex*. BAR British Series 242. Oxford: British Archaeological Reports.