**Environmental Archaeology Unit, University of York**

# Research Forum 1995:

# Current and future research in the EAU

*Abstracts from a one-day forum*
*held in Derwent College, University of York*
*on 18th October 1995*

Environmental Archaeology Unit
University of York
York YO1 5DD, UK.

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Compiled by D. Jaques and H. Kenward

Environmental Archaeology Unit
University of York
York YO1 5DD, UK.
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*The current staff of the EAU*

**Ancient Monuments Laboratory Fellows**

| | |
|---|---|
| Keith Dobney | vertebrates |
| Allan Hall | plant remains |
| Harry Kenward | Director; invertebrates, especially insects |
| Annie Milles | molluscs |
| Raimonda Usai | soils and sediments |

**Palaeoecology Research Services**

| | |
|---|---|
| John Carrott | microfossils, particularly parasite eggs, and computing |
| Michael Issitt | Technician |
| Deborah Jaques | vertebrates |
| Frances Large | insects |

The Unit's Line Manager in the Department of Biology is Professor Alastair Fitter.

## Research Forum 1995: Current and future research in the EAU: Program

**Professor Alastair Fitter** (Department of Biology, York): Welcome and introduction.

**Professor Don Brothwell** (Department of Archaeology, York): *The Palaeoecology Centre and research in the EAU.*

**Dr Keith Dobney** (EAU): *Late Roman economics in Lincoln.* With Deborah Jaques and Harry Kenward (EAU), and Lisa Donel and Dr Alan Vince (City of Lincoln Archaeology Unit).

**Steve Roskams** (Department of Archaeology, York): *Residuality and bioarchaeological materials.* With Dr Alan Vince (City of Lincoln Archaeology Unit) and Dr Keith Dobney (EAU).

**Dr Susan Colledge** (Department of Archaeology, University of Cambridge): *Contextual analysis of the use of space: two near eastern Bronze Age sites.* With Dr Keith Dobney (EAU).

**Dr Allan Hall** (EAU): *The ABCD, a resource for palaeobotany*. With Dr Philippa Tomlinson (Centre for Manx Studies, Isle of Man).

**Harry Kenward** (EAU): *Principles from biogeography applied to insects from past occupation sites.*

**Dr Raimonda Usai** (EAU): *The use of micromorphology in geoarchaeological studies.*

**Dr Allan Hall** (EAU): *Northern regional review*. On behalf of the AML Northern Group (Universities of York and Durham).

**John Carrott** (EAU): *Paradox-based recording systems for environmental archaeology*. With the EAU team.

**Cluny Johnstone** (Department of Archaeological Sciences, University of Bradford): *A touch of reality: the EAU as a training experience.*

**Harry Kenward** (EAU): *Extending the range of macro-invertebrates.* With Frances Large (EAU), Peter Skidmore (Doncaster Museum) and Jaap Schelvis (Scara*B*, Groningen, Netherlands).

**Ian Barnes** (Department of Biology, University of York): *Providing the* Anser: *recent biomolecular work on the identification of archaeological geese remains.*

**Professor Don Brothwell** (Department of Archaeology, York): *A pain in the neck? Possible evidence of oxen yokes from perforations in archaeological* Bos *crania.* With Dr Keith Dobney (EAU).

**Discussion session**: *Prospects for future research*

**Professor Alastair Fitter**: Summing up

# The Palaeoecology Centre and research in the EAU

*Don Brothwell (Department of Archaeology, York)*

York is well-known for its long-established Environmental Archaeology Unit. Its existence pre-dates the Department of Archaeology, and thus its development has been in the Department of Biology. There is now clearly a need to consolidate the Unit's links to both departments and to acknowledge that these environmental studies have come of age and represent the emergence of a distinct research area which is best termed ***human palaeoecology***. This is broadly based and represents a core subject in archaeology as well as being clearly locked into the natural sciences. Any transformation of this kind brings with it problems, especially in terms of the balance between problem-linked research and site-orientated reporting.

# Late Roman economics in Lincoln

*Keith Dobney (EAU), with Deborah Jaques and Harry Kenward (EAU), and Lisa Donel and Alan Vince (City of Lincoln Archaeology Unit)*

During the late 1980's, the City of Lincoln Archaeology Unit undertook a series of major excavations in the waterfront area of the city. The deposits encountered were interpreted as large 'dumps' of 'urban waste', possibly used to consolidate the often waterlogged river bank. The fact that these waterlogged deposits could be tightly dated to the late 4th century gave them the highest priority for study. The vertebrate and invertebrate remains recovered from these sites have been studied in detail by staff at the EAU, and a synthesis of the most interesting results are presented in this paper.

Material from the waterfront represents a significant part of the archaeological evidence of the late Roman period, with the vertebrate assemblage representing the largest of its kind so far recovered from Britain. The sheer size and character of this cattle-rich assemblage suggests a commercial butchery regime, more traditionally associated with earlier military establishments, and not that of a civilian *Colonia* at the end of the Roman period. Evidence from Lincoln, and from late 3rd century material from the General Accident and Wellington Row sites in York, suggests that this centralised, large-scale, butchery of cattle may well have continued to be feature of large civilian settlements into the later Roman period.

As well as the obvious evidence for the production of meat, the vertebrate assemblage contains what may be interpreted as indications of various specialist activities, based on other animal products and possibly carried out by a number of different individuals or organisations. These activities appear to be centred primarily around marrow and marrow-fat extraction, and not soup stock or glue production. The systematic burning of the diastema region of a high proportion of the mandibles (with little or no evidence of burning on other elements) seems to indicate that jaws were heated and then broken so that marrow could be poured from the bone. This may suggest that a more refined product was being extracted, perhaps for use in lamps or possibly even cosmetics.

The copious invertebrate remains indicate that large scale dumping of waste occurred, often directly into water. The overall rarity of fly puparia from the bone-rich deposits, and the pristine appearance of most of the bones, strongly suggest that bone waste was fairly fresh when it was collected and dumped. Very large amounts of offal would have been produced by the slaughter of hundreds of cattle, particularly the contents of the rumen, which must have been discarded. There is little evidence for this component from the samples, although gut contents may mimic characteristic invertebrate assemblages from stable manure or hay. The presence of reasonably high quality buildings (probably still heated to allow the oriental cockroach to persist) is indicated, as is some reasonably high level of socio-economic organisation which allowed continued large-scale grain storage.

These lines of evidence suggest that a large and vigourous economic unit, possibly sustaining a large population, existed at a time when, in most late Roman centres, urban decay was supposedly already well under way. This view of late Roman decline is, however, now being challenged and the biological remains from Lincoln provide a substantial corpus of relevant data.

## Residuality and bioarchaeological materials

*Steve Roskams (Department of Archaeology, York), with Alan Vince (City of Lincoln Archaeology Unit) and Keith Dobney (EAU)*

Rescue excavation has been successful in producing a large volume of material in the past two decades, the rationale for which is the need to obtain groups of artefacts and environmental samples in the context of a detailed knowledge of stratigraphic and structural information from sites. However, the discipline has been far less accomplished in integrating the different sets of data.

Nowhere is this failing more clear than in the problems posed by 'residual' finds. Work has been done on various methods of artefact quantification, for instance in measuring brokenness of pottery; on recording properties such as bone fragmentation; and on integrating the spot dating of finds with stratigraphy.

This talk presents, in outline, a project which will seek to integrate the information from each sphere and relate it to the classification of site features. As a result, we will achieve two objectives: expanding our academic understanding of the processes of site formation and redeposition; and, equally important, putting forward proposals on how 'best practice' can be implemented in the strategies to be adopted during evaluation, excavation and post-excavation analysis.

# Contextual analysis of the use of space: two near eastern Bronze Age sites

*Susan Colledge (McDonald Institute, University of Cambridge), with Keith Dobney (EAU)*

A project funded by the Leverhulme Trust was initiated at the beginning of this year with the aim of investigating the use of space on two near eastern sites; Tel Brak in North-Eastern Syria and Kilise Tepe in southern Turkey. The project was inspired by, and followed on from, earlier research undertaken by Sebastian Payne whilst working at Tel Abu Salabikh, southern Iraq. There, he examined a range of finds assemblages (e.g. bones, charred plant remains, shell, fragmented pottery, flint etc.) and found that there were patterns to the distribution, quantity and quality of these between the various context types (e.g. rooms, courtyards, lanes, middens) which had been sampled. He concluded that this might reflect differential use of the living spaces by the inhabitants of the site. This approach was continued and expanded by Michael Charles, KD and Wendy Matthews at the same site during subsequent seasons.

The Tel Brak and Kilise Tepe project was designed to pursue these ideas and to test the results at two further Tel sites and this paper outlines the research objectives as well as providing some preliminary information on the first season of work.

Much time has been spent designing and implementing a rigorous sampling strategy, in addition to determining suitable recovery procedures, which involve both flotation and wet-sieving. A team of specialists will be working on the different materials and this year in the field KD and Polydora Baker (UCL) carried out the preliminary recording of the vertebrate remains recovered from the first seasons at Tel Brak and Kilise Tepe respectively. The soil micromorphology of floor layers is also being investigated (by Wendy Matthews) to determine how these materials were deposited, once again with the aim of defining activities that may have taken place on and around the floors.

After this initial season at both sites it is clear that the work will entail a detailed study of the methodological problems inherent to the research: for example, how to standardise subjective recording of fragmentation and preservation of the various classes of material, and how to compare the results between datasets. It is vital for this study that there is not only a fully integrated approach, but also clear recognition of the obvious limitations of the data, particularly with regard to the complex questions regarding residuality.

# The ABCD, a resource for palaeobotany

*Allan Hall (EAU), with Philippa Tomlinson (Centre for Manx Studies, Isle of Man)*

The Archaeobotanical Computer Database (ABCD) is a PC-based relational database holding information abstracted from published reports on macrofossil plant remains from archaeological sites throughout the British Isles. It currently contains over 27,000 records of plant remains from nearly 1,000 sites, the data coming from reports published between 1840 and 1992, and covering all archaeological periods. As well as lists of taxa, plant parts recorded, and type of preservation, the database holds information about the archaeology of the sites (date, site type, context types).

The ABCD will be an invaluable tool for archaeobotanists and others interested in the past flora of the British Isles and in the past use of plants by humans. It was compiled by PT at the Environmental Archaeology Unit and it is planned that it will be continually updated and maintained at the EAU under the supervision of PT and AH .

It is expected that the information held in the ABCD should be available to the academic community in two ways. Firstly, requests for specific information (e.g. a set of records for a particular taxon or period) will be dealt with by the database manager, who will supply output on paper or as ASCII or other files as requested. Secondly, copies of the ABCD will be distributed on PC disk (3.5" format) as ASCII files (for loading into any database package) or Borland *Paradox*® tables (these can be used in any version of *Paradox* for MS-DOS® or *Paradox* for Windows™). Scripts and ObjectPAL™ Forms will be developed to assist those using *Paradox* to extract data. The database in its *Paradox* format currently requires ~3Mb of disk storage capacity. *Paradox* tables can be easily converted into files which dBase III™ can read.

This contribution gives a brief overview of the ABCD, together with some thoughts on its use in archaeobotanical research.

**Further information about the ABCD, including requests for information, copies of the database (and charges, where appropriate) may be obtained from Dr Allan Hall, ABCD, Environmental Archaeology Unit, University of York, Heslington, York YO1 5DD, U.K. (Tel. +44 1904 433851/Fax. 433850/e-mail biol8@york.ac.uk).**

# Principles from biogeography applied to insects from past occupation sites

*Harry Kenward (EAU)*

Many insect species associated with decomposing matter are weakly to strongly synanthropic, that is, more or less strongly favoured by habitats created by human occupation and activity. From the perspective of such insects, occupation sites can be viewed as 'islands' in a sea of less favourable, or entirely inhospitable, habitats. Principles developed in the study of island biogeography are therefore relevant to models of the invasion of past occupation sites, and to the nature of insect populations able to survive in them.

Thus, new sites will have been invaded by synanthropic insects at a rate roughly proportional to their size and distance from established centres. Other relevant factors will have been site utilisation and complexity (and hence the range of habitats created), and the degree of continuity of occupation. The level of contact with other settlements will also have been very significant. Data sets from a wide range of archaeological sites have been examined. The number of sites for which data are available is inadequate for clear, testable, patterns to emerge because of the extreme heterogeneity of site types. However, the results so far obtained suggest that the approach has considerable potential in archaeological studies, and it will be explored further.

# The use of micromorphology in geoarchaeological studies

*Raimonda Usai (EAU)*

There may be considerable limitations to the suitability of micromorphology for investigations of soils, sediments and finds in archaeological sites. Standardization of interpretative criteria has been hindered by the complex nature of soils and sediments. Consequently, comparability of terminology and results is often restricted.

Micromorphological features resulting from ancient depositional processes and/or past interactions between man, organisms, environment, and time, are often obliterated. This may be the effect of aggradational and slope processes or human occupation which interrupt soil evolution (*'relic paleosols'*), bury older soils (*'buried paleosols'*), and cause younger sediments to exert an influence on the older units. Alternations of environmental changes and inputs of materials often cause complex successions of soils and sediments, with some layers containing transported material. Thus, features generated by different causes, during different time periods, and in different places, can be superimposed on the same material and in the same thin section.

The number of thin sections necessarily depends on soil variability, catenary variations, and the availability of field evidence and other suitable information (work on variability has shown that in some cases 42 sections per horizon were needed!). Furthermore, many soil features are ephemeral, or very susceptible to change, and rapidly adjust in relation to local agents. Thus, rather than being diagnostic for an archaeological context, they can indicate successive, or even modern, conditions (e.g. some peds, cracks and mottles). Voids, for example, can be obliterated or modified by compaction, but their traces may be suggested by clay quasi-coatings (clay skins within the fabric) located in the positions of former voids, as in paleosols near Low Hauxley (Northumberland).

In order to be diagnostic of past conditions, soil features should logically correlate with a suitable model of the past environment and human occupation. This can be achieved by combining micromorphology with sufficient field work, and other parallel lines of evidence. Such an approach can help to test the micromorphological evidence, reduce the number of thin sections necessary to represent a unit, and enhance the power of micromorphology, e.g. for establishing the order of occurrence and relationships of features, the degree of soil evolution and the human influence on soils and sediments, the type and depth of waterlogging, and other applications.

Proving the micromorphological evidence using specific tests or parallel evidence requires a significant amount of work. This approach may reduce the number of results but will improve their reliability.

# The Northern Regional Review

*Allan Hall (EAU), on behalf of the AML Northern Group (Universities of York and Durham)*

At the request of English Heritage's Ancient Monuments Laboratory, the Environmental Archaeology Unit, together with it's sister Unit in the Department of Archaeology, University of Durham (and in parallel with all the other EH-funded contract environmental archaeologists in other parts of England), has prepared a project design for a Regional Review of environmental archaeology in the north of England. The purpose of such a review is to take stock of what is currently known, identify lacunae, and establish priorities for the future in the contexts of PPG16, *Exploring Our Past*, and academic research within universities. It is intended that the review will create a research framework for the next decade, but also that mechanisms will be suggested to ensure that the minimum amount of material with research potential is lost in future as a result of shortcomings of developer-funded excavation and the inevitable limits on funding for EH-sponsored work.

If the plan put forward is agreed by EH, the review will be carried out in two stages:

(a) the production of a series of material reviews (e.g. of plant remains or molluscs), with clear structuring and internal cross-references and

(b) the production of (i) an overall synthesis based on the material reviews, including (ii) summary recommendations which can be disseminated *separately* to curators and others.

This contribution will present some of the details of the proposed structures for the material reviews and synthesis as well as an outline of the possibilities for publishing the results of the review.

# Paradox-based recording systems for environmental archaeology

*John Carrott (EAU) with the EAU team*

The storage, processing and analysis of data is an ever increasing part of environmental archaeology, and the ability to combine all of the archaeological information from a site is a prerequisite of accurate interpretation.

A number of factors, including the demise of the University of York's VAX mainframe earlier this year, have precipitated a fundamental redesigning of the EAU's methods for data entry and storage. The EAU has settled on Borland® Paradox® for Windows™ as the basis for its recording systems, both archaeological and administrative, for several reasons including ease of use, graphical input and output capabilities, compatibility with other software and the potential to integrate already existing datasets into a unified whole.

The design of each system presents its own difficulties, for example, in the case of insect remains backward compatibility with previous recording systems and the need for seamless data exchange between Windows™ applications (some of which may need to be custom-written) for particular input or analytical processes, or for data presentation. These must be overcome system by system whilst retaining the capability to link the individual datasets together as required.

# A touch of reality: the EAU as a training experience

*Cluny Johnstone (Department of Archaeological Sciences, University of Bradford)*

The Department of Archaeological Sciences in Bradford is the only university in the country to offer a sandwich course in Archaeology or Archaeological Sciences. The year on placement allows the undergraduate students a chance to sample the real world of archaeology. The year is divided into two six month placements, each with a different institution. Some institutions, the EAU being one, shortlist candidates and then interview them to find the most suitable. This was the first touch of reality.

I started my placement at the EAU in October 1994. I started the learning experience by being taught how to sieve soil samples. I spent a few days doing this before feeling that perhaps I might like to do something else. I was allowed into the bone room the following week and somehow contrived to stay there the rest of the six months. It was amazing how quickly I started to be able to identify the more common domestic species without much trouble, mainly due to the constant contact with them. I think that for a subject like environmental archaeology the 'hands-on' approach is the only satisfactory way to learn and the placement gives the opportunity for this.

I was given a project of my own to do from start to finish with as little help as possible after only two months in the EAU. This was the first real experience of technical writing I'd had. Everyone has to start somewhere I suppose but I didn't think it was possible to fit so much red pen on a document! My reports got progressively less red pen on them as I learned to write in a formula and got used to the technical language. Another fairly big project from the site at Malmo Road in Hull took me to the end of my placement.

During my time at the EAU I had learnt an amazing amount about bones but also a lot of very useful skills that would fit into any work I may do in the future. I also saw the realities of daily life in the workplace under stress. The work I was doing at the EAU has spawned several ideas including a dissertation. The other great advantage of a placement is that employers are very keen on the experience gained during one. The EAU is also so well regarded by the archaeological world that anyone trained there has an advantage. The EAU gave me such a good training in six months that I was confident enough to tackle professional work on my own. After six months training I also have a substantial stack of reports with my name on them, a testimony to the harsh life and pressures of the real world of competitive tendering and deadlines.

## Extending the range of macro-invertebrates

*Harry Kenward (EAU), with Frances Large (EAU), Peter Skidmore (Doncaster Museum) and Jaap Schelvis (ScaraB, Groningen, Netherlands).*

The great majority of systematic studies of arthropod remains from archaeological sites have concentrated on beetles, other groups usually being wholly neglected or considered in a very inconsistent way because of real or imagined difficulties of identification or a perception that they were too rare to be of use. Sporadic work over the past 20 years has repeatedly shown the potential of 'other orders' among the insects. Fleas and lice, true bugs, some Hymenoptera (ants, bees and wasps), and occasionally other insects, have been identified to good effect. Fly puparia (and other fly remains) are now seen to be identifiable given sufficient experience, and are strongly complementary to beetles in their potential for archaeological interpretation.

Some non-insects are also proving useful. The mites have also been shown to be both approachable and archaeologically valuable, and (like the flies) have attributes which make them particularly useful when studied together with beetles and other insects.

It will rarely be possible to explore the full range of macro-invertebrates from any site in detail; the cost would be too great. The authors are exploring parallel studies of a wide range of arthropods, including flies, beetles and mites, from archaeological occupation deposits with a view to determining appropriate uses for each group. This work, and collaboration with Allan Hall in developing the concept of 'indicator groups' of remains of organisms believed to have been associated with particular activities or circumstances in the past, seems to be leading inexorably to the abandonment of isolated specialist studies. Work on single groups appears generally to be of less value to archaeological reconstruction than very carefully targeted use of particular organisms considered most likely to elucidate the problems at hand. Simply recording remains 'because they are there' is an empty exercise; detailed recording is hard to justify unless there is a clear archaeological or palaeoecological objective, either for 'service' or 'research' .

# Providing the Anser: recent biomolecular work on the identification of archaeological geese remains

*Ian Barnes (Department of Biology, York)*

The remains of wild and domestic geese are commonly recovered from archaeological sites in NW Europe, particularly in the Saxon and medieval periods. Up to six species are believed to be represented. However, identification of the material to species level is hampered by a lack of morphological variation and a large overlap in size.

In order to address this issue, we have initiated a project to identify these species by genetic variation. If suitable variation can be found in the DNA of modern samples, ancient DNA from archaeological material can be extracted, amplified and characterised. This will allow species identification, and data can then be integrated with paleoenvironmental and historical information on past distributions, wild fowling strategies and domestication processes. This paper will discuss the progress made so far, some of the difficulties of the project, and work proposed for the future.

# A pain in the neck? Possible evidence of oxen yokes from perforations in archaeological *Bos* crania

*Don Brothwell (Department of Archaeology, York), with Keith Dobney (EAU)*

During post-excavation analysis of the Lincoln vertebrates, an unusually high incidence of perforations of definite ante-mortem origin in the occipital region of 4th century cattle skulls was noted. It has been known for some time that holes with rounded margins occur in some bovine skulls of various periods, although usually at low frequency. On the basis of further research, we are aware of at least fifteen sites (from Britain and mainland Europe) where cases have occurred.

These rounded holes are situated below the frontal and nuchal eminences, which form the ridge between the two horncores. We have, as yet, not seen any cases of perforations extending into the region of the external occipital protuberance or linea nuchae superior. In the region of the eminences between the horncores, the extensive frontal sinus system comes close to the external surfaces of the skull. Perforation through the relatively thin diploic bone in this area could thus occur without considerable bone remodelling - whether of traumatic, inflammatory or other origin.

It is difficult to find a convincing explanation for the presence and apparent diversity of these perforations in the 4th century cattle skulls from Lincoln. The fact that almost none shows associated signs of any active or chronic pathological condition may suggest them to be of genetic or developmental origin. After all, other similar non-metrical traits (i.e. absent second premolars, reduced or absent hypoconulids, variation in the mental foramen and the presence of a lingual foramen) have all been recorded from this assemblage. However, the well remodelled appearance of the margins of all these lesions is perhaps more suggestive of a physical causal agent.

One explanation may be that these holes are the result of a parasitic infestation. Perforations have been found in the skulls of polecats, stoats and weasels from Britain, a result of small burrowing parasitic roundworms, usually located in the frontal and ethmoidal sinuses. However, we have found no veterinary parallels for similar roundworm damage to cattle skulls. Infestation of the nasal area and frontal sinuses by headfly larvae are documented for sheep, horses and deer, although again no clinical evidence of skull perforation is known to exist. Perhaps a more plausible explanation may be the wearing of yokes by cattle. Constant pressure caused by abnormal stress on the neck, or from an ill-fitting yoke, occurring over long periods of time, may well have resulted in localised remodelling of these areas. Moderate frequencies of joint disorders, in addition to the high proportions of adult animals in the assemblage, support the conclusion that most of these beasts were used for traction.

Further research is needed, particularly on specimens or assemblages of known status, including modern draught animals, ancient wild material (i.e. *Bos primigenius*), and archaeological assemblages where age and sex profiles and historical evidence indicate a non-traction role, in order to establish the aetiology of this condition.

# List of participants

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# About the EAU

The Environmental Archaeology Unit is a research unit within the Department of Biology at the University of York. It was established in 1975 with funding from the Historic Buildings and Monuments Commission (Department of the Environment) and the Leverhulme Trust. Currently five Research Fellows are funded by the Ancient Monuments Laboratory of English Heritage, and a variable number of other staff (typically five) are supported from commercial contracts and English Heritage project funding. Strong contacts have grown with other institutions including many archaeological units and university departments. The Unit has recently associated itself with members of the Department of Archaeology to form the Palaeoecology Centre.

The Unit strives towards an integrated approach to environmental archaeology, drawing together information from many aspects of the subject, including studies of soils and sediments, pollen, plant macrofossil remains of all kinds, invertebrates (including parasitic nematodes, insects and other arthropods, and molluscs), and vertebrates. We consider that the integration of evidence is crucial in building a more solid foundation for the interpretation of the evidence as a whole from archaeological deposits, leading to the recovery of much more valuable information than work on single groups or isolated parallel studies.

The EAU Fellows, together with two staff in the Biological Laboratory at Durham, constitute the Northern Regional Team of AML contractors. The co-ordinator of the Northern team is based at York. Both groups are charged with providing advice concerning all aspects of environmental archaeology, carrying out assessments and main phase site projects, and executing programmes of research and review.

Commercial work is carried out in the EAU by Palaeoecology Research Services (formerly the EAU Contract Group). PRS is able to organise and execute environmental archaeology studies of most kinds, including evaluations, drawing on a wide range of expertise. More information can be obtained from PRS staff (telephone 01904 443846, fax 443850).