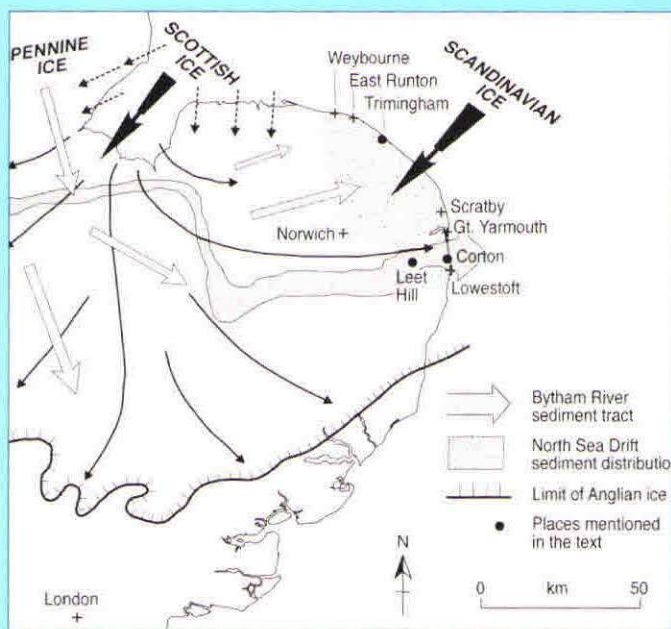


# QN

## Quaternary Newsletter



# QUATERNARY NEWSLETTER

## EDITOR:

Dr Julian Murton

Centre for Environmental Research

School of Chemistry, Physics and Environmental Science

University of Sussex

Brighton BN1 9QJ

Tel: 01273 678293 Fax: 01273 677196

e-mail: j.b.murton@sussex.ac.uk

*Quaternary Newsletter* is issued in February, June and October. Articles, reviews, notices of forthcoming meetings, news of personal and joint research projects, etc. are invited and should be sent to the Editor. Closing dates for submission of copy (news, notices, reports etc.) for the relevant numbers are 1<sup>st</sup> January, 1<sup>st</sup> May and 1<sup>st</sup> September. These dates will be strictly adhered to in order to expedite publication. **Articles must be submitted at least 6 weeks before these dates in order to be reviewed and revised in time for the next issue of QN, otherwise they may appear in a subsequent issue.** Authors are encouraged to submit material as e-mail attachments, with text in Word format and diagrams and black-and-white photographs in .eps format.

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## COVER DIAGRAM:

Location map showing Trimingham and Corton, the distribution of the North Sea Drift, Anglian ice-flow directions and the sediment tract of the Bytham River (see report by Lee in this issue, pp. 40-41).

# ARTICLES

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## HOLOCENE VEGETATION CHANGE AT WYTHAM WOODS, OXFORDSHIRE

Rebecca Hone, David E. Anderson, Adrian G. Parker  
and Michael D. Morecroft

### Introduction

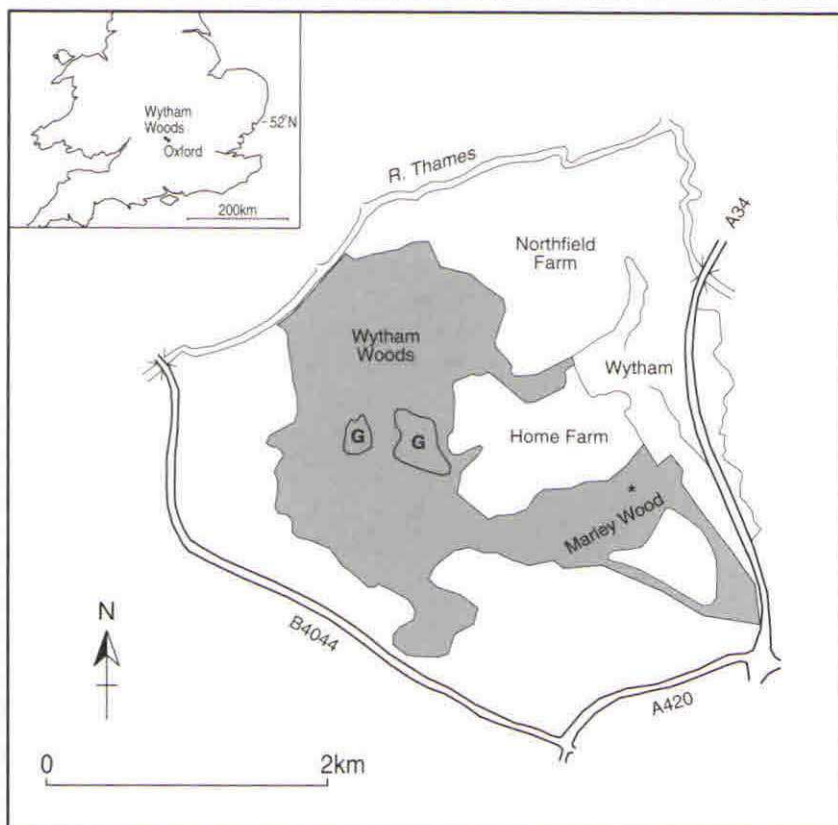
Wytham Woods in Oxfordshire is a classic site for field ecology. From the work of Charles Elton in the mid 20<sup>th</sup> century through to the present, Wytham Woods has been an important focus for ecological research, providing the field data for over 500 scientific papers (Perrins, 1989). Today the importance of the site for ecological and environmental research is reflected in its designation as an SSSI and as an ECN (Environmental Change Network) site. It was also a flagship site for NERC's TIGER (Terrestrial Initiative on Global Environmental Research) programme. Despite such intensive study over the years in so many areas of environmental science, there has been a lack of palaeoecological research. Until now, therefore, there has been little knowledge of what constituted the natural forest cover of Wytham prior to widespread woodland clearance for agriculture and selective planting from the Middle Ages onwards. Here we present preliminary results from a pollen study on a 2-m sedimentary sequence extracted from a hillside fen in Marley Wood, in the southern part of the Wytham estate. From correlation with other more detailed pollen studies in the Oxford region, it is clear that the sequence from the Marley Wood fen spans much of the Holocene. Therefore, this pilot study provides the first long-term vegetational history for Wytham, and it highlights the suitability of the Marley Wood fen for more detailed palaeoecological investigations in the future. This is especially important considering the lack of sites suitable for palaeoecological analysis in southern England compared with other parts of the country (Parker, 1995).

The main findings are as follows. At the base of the sequence there is abundant *Pinus* pollen, supporting the view that pinewoods were an important woodland type in the Oxford region during the early Holocene. Perhaps the most important feature in the record is the high value of *Tilia* (lime) pollen (over 40% of  $\Sigma$ TLP) found in the mid-section of the core. The pollen record also shows a distinct mid-Holocene elm decline, a precipitous decline in all arboreal taxa (and a rise in grasses) later in the sequence, and finally an increased diversity of arboreal taxa towards the top of the sequence. Large parts of Wytham

Woods, including Marley Wood, are ancient, in the sense that there is good evidence for continuous forest cover extending from at least AD 1600 to the present (Peterken, 1993). However, from a perspective of thousands of years, this study shows that the change in tree species, particularly the decline in lime, has been considerable since human disturbance began.

### The site, fieldwork and laboratory methods

Wytham Woods and the University Farm are part of an estate (covering approximately 1240 ha) owned by Oxford University and situated about 5 km north west of Oxford (Figure 1). The estate spans two low hills enclosed by a meander of the River Thames, and the geology consists of Jurassic Corallian



**Figure 1.** The location of Wytham Woods with respect to Oxford (inset) and the location of the Marley Wood fen near the south east boundary of Wytham Woods (marked with an asterisk). The woodland area is shaded, and 'G' marks areas of grassland within the woods.

limestone underlain by a band of Greensand which in turn is underlain by Oxford Clay. About 400 ha of the estate are woodland set aside for research and conservation while about 370 ha of farmland are managed for research and commerce (Gibson, 1986). The fen under investigation is located on a hillside, between 90 and 125 m above sea level, within Marley Wood near the south east boundary of Wytham Woods (SP 478078) (Figure 1). The fen is calcareous and is composed of a mixture of grasses, reeds, sedges, mosses and perennial herbs. Abundant taxa include *Phragmites australis*, *Carex spp.*, *Mentha aquatica*, *Galium aparine*, *Filipendula ulmaria*, and *Equisetum telmateia*.

After surveying the general bathymetry of the fen, sediments were extruded using a 50-cm Russian corer with 1-m extension rods (Jowsey, 1966). Following extrusion, cores were quickly wrapped in cling film and aluminium foil and later transferred to cold, dark storage until needed for laboratory analyses. Two overlapping, adjacent cores were extruded from the fen in order to ensure sufficient material for analyses and to minimize the problem of sediment distortion between each drive of the corer.

In the laboratory, cores were described using the system of Troels-Smith (1955) and then sub-sampled for both physical and pollen analyses. Physical analyses included wet and dry bulk density, loss on ignition (LOI) and percentage carbonate following Bengtsson and Enell (1986). Pollen samples were prepared and counted according to the methods described by Moore *et al.* (1991), and pollen data were plotted using TILIA software (Grimm, 1991).

### The sediment stratigraphy

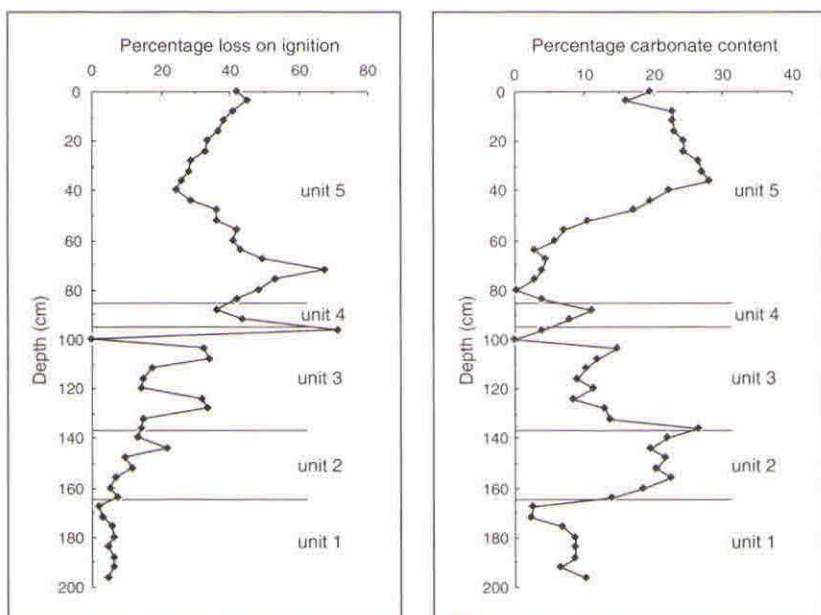
A sedimentary sequence was recovered from 200 cm depth to the fen surface. The stratigraphy can be subdivided into five main units (Table 1). Unit 1 extends from the base to 165 cm and is light grey clay. This unit is overlain by marl-rich sediment spanning 165 to 137 cm (unit 2). This sediment is heavy and compact, and the humification of organic matter ranges from moderate to high. It contains light and dark banding, perhaps indicating changes in water level and marl formation during a hydrosere succession from pond to fen. From 137 to 95 cm (unit 3), the sediment is more homogenous in colour and composition, with a general increase in organic content upwards. A lighter coloured band from 95 to 86 cm (unit 4) separates the lower peat in unit 3 from an upper section of peat extending from 86 cm to the fen surface. This upper section (unit 5) contains more fibrous plant matter - mainly *Phragmites* - of moderate humification.

The physical properties of the sequence are further illustrated by the LOI and carbonate content curves (Figure 2). The basal clay (unit 1) features both a low LOI and low carbonate content. However, with the transition into the marl-rich



Table 1. Core stratigraphy.

Units	Depth (cm)	Components	Physical properties	Description
5	86 - 0	Th <sup>2</sup> (Phrag)4 TI <sup>2</sup> +	nig 3 sicc 3 elas 2 strf 0 humo 2	peat - dark brown, fibrous, abundant herbaceous and woody remains, moderate humification
4	95 - 86	Th <sup>2</sup> 1 TI <sup>2</sup> 1 Lc1 As1	nig 1 sicc 3 elas 1 strf 0 humo 2	light coloured band, interspersed with darker plant fragments
3	137 - 95	Th <sup>3</sup> 1 TI <sup>3</sup> 1 Lc1 As1 Ag+	nig 3 sicc 3 elas 1 strf 2 humo 3	peat - dark brown and fairly homogenous but some light banding, marl particles present, plant matter highly humified
2	165 - 137	Lc2 As1 Ag1 DI+ Dh+	nig 2 sicc 3 elas 1 strf 3 humo 3	heavy and compact, carbonate-rich, light and dark banding, moderately to highly humified plant detritus
1	200 - 165	As4 Lc+	nig 1 sicc 3 elas 0 strf 0	light coloured grey clay

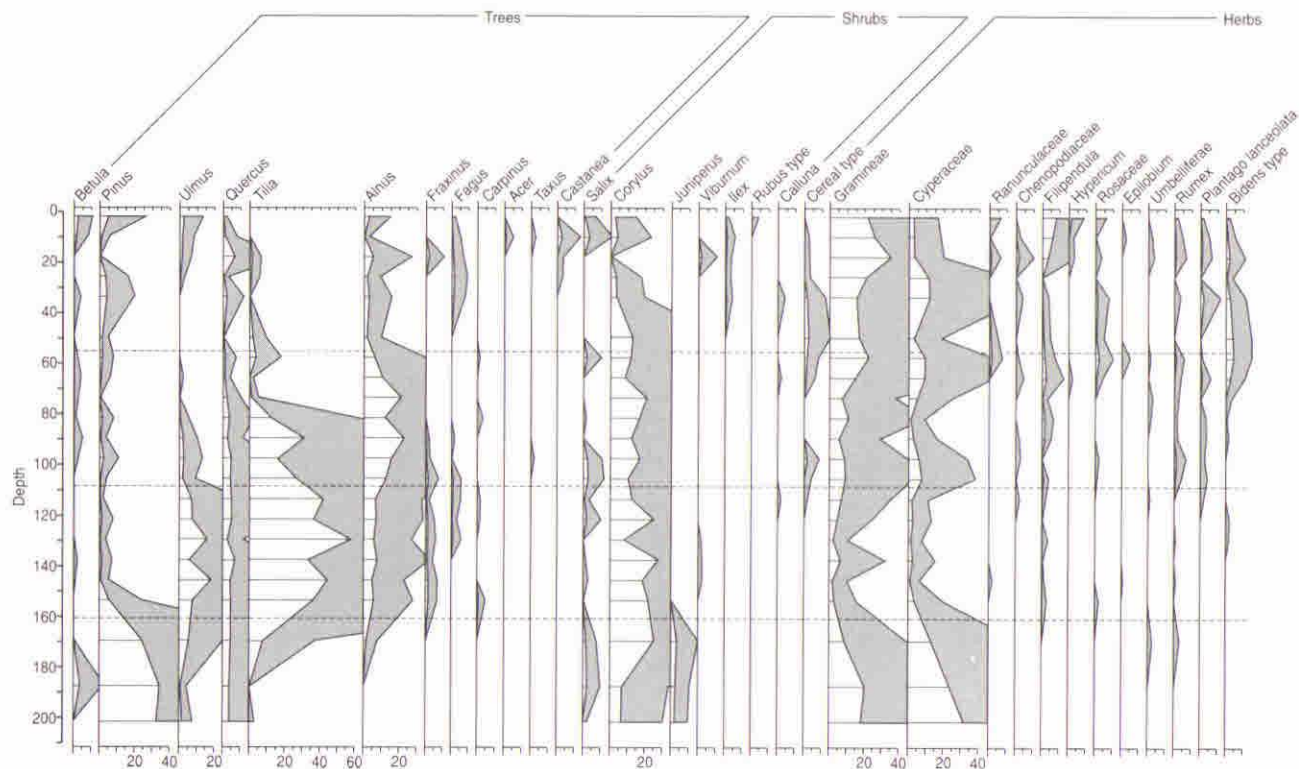


**Figure 2.** Percentage loss on ignition and percentage carbonate content for the Marley Wood fen sequence plotted against depth.

unit 2, the percentage carbonate rises sharply from below 10 to over 20%. The abrupt nature of this increase in carbonate suggests a possible break in sedimentation at 165 cm, but this could only be demonstrated by analyses at a finer sampling resolution across this unit boundary. Unit 3 shows rising, though variable, LOI values, peaking at about 70% at 97 cm. Unit 4 features a sharp trough in LOI matched with a minor peak in carbonate content. Unit 5 shows a return to a high LOI at about 75 cm, followed by a decline and then a rise in LOI towards the fen surface. An inverse relationship between LOI and carbonate content is displayed clearly in unit 5 and, to a lesser extent, throughout the sequence.

### The pollen analysis

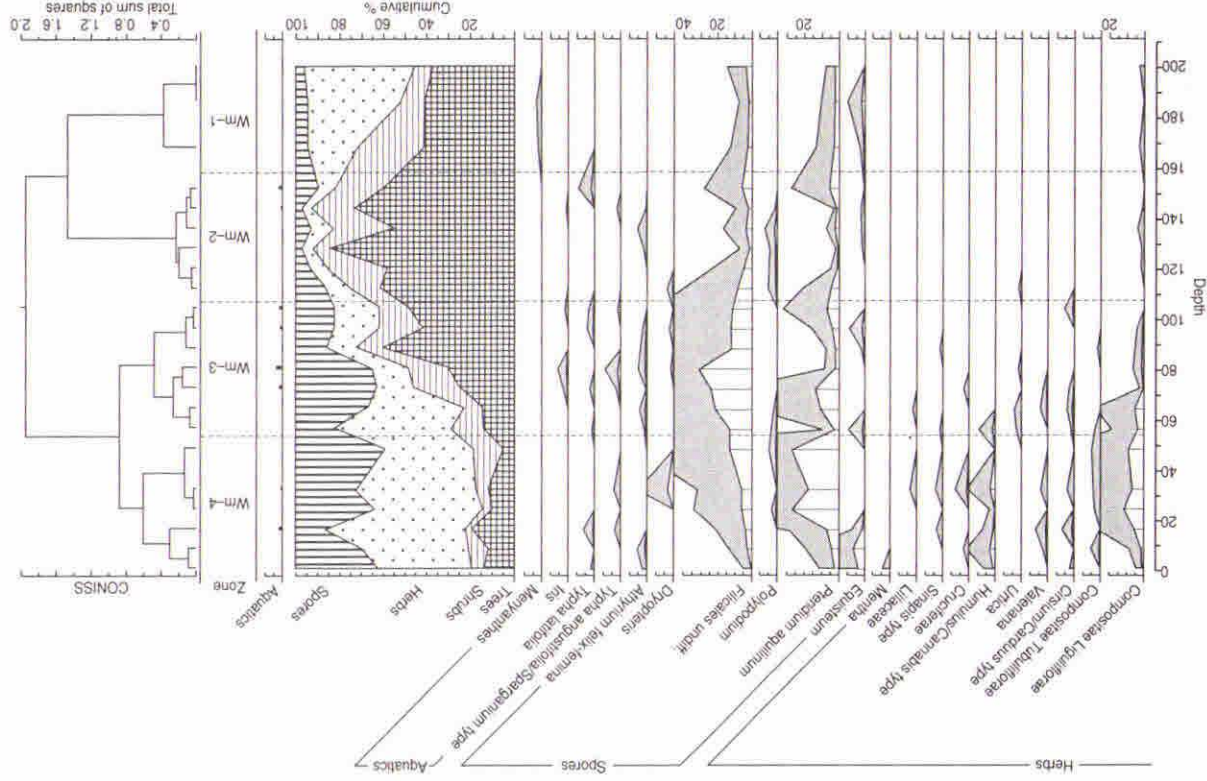
The Wytham pollen diagram shows changes in the abundance of taxa as a percentage of the total land pollen sum ( $\Sigma$ TLP) with respect to depth (Figure 3). Application of the CONISS cluster analysis programme within the TILIA package has helped to identify four main pollen zones spanning the sequence.



**Figure 3.** The Wytham pollen percentage diagram derived from the Marley Wood fen sequence. Taxa are presented as a percentage of the total land pollen sum ( $\Sigma$ TLP, including spores and excluding aquatics) and are plotted against depth (cm). The stippled outline indicates x5 exaggeration, and the cumulative % graph shows the relative contribution of each major group of taxa as a percentage of  $\Sigma$ TLP.



Figure 3. (continued)



### **Zone Wm-1 (200 to 160 cm) (*Pinus*-Cyperaceae-Gramineae zone)**

Zone Wm-1 at the base of the sequence is only represented by three samples because relatively poor pollen preservation in the basal clay unit made further sampling too time consuming for the purposes of this pilot study. This zone is highly dissimilar to zones higher in the sequence in that it features a high percentage of *Pinus* pollen (averaging around 30% of  $\Sigma$ TLP), some *Juniperus* pollen (about 5%) and abundant Gramineae and Cyperaceae pollen. *Ulmus* and *Quercus* are present from the base upwards, but at low percentages (5% or less). *Tilia* and *Corylus* pollen rise towards the top of the zone as *Pinus*, Gramineae and Cyperaceae decrease. Other than Gramineae and Cyperaceae, few herb types are represented, although spores (e.g. *Equisetum*, *Pteridium* and Filicales undiff.) and aquatics (*Menyanthes*) feature at low percentages.

### **Zone Wm-2 (160 to 108 cm) (*Tilia*-*Corylus*-*Ulmus* zone)**

From 160 cm upward through the sequence pollen preservation is good and slides are rich, allowing for a more detailed sampling resolution than in the basal zone. The organic content of the sediment generally increases through the zone as shown by the LOI curve (Figure 2). Zone Wm-2 is dominated by *Tilia* and *Corylus* pollen. The former fluctuates around 30% of  $\Sigma$ TLP, peaking at nearly 60% at 130 cm, and the latter fluctuates between 10 and 20% through most of the zone. After *Tilia*, *Ulmus* is the second most important arboreal pollen taxon, ranging between 5 and 15% of  $\Sigma$ TLP, followed by *Alnus* and *Quercus* at around 5% or less. Herbaceous pollen is not strongly represented in this zone, with Gramineae pollen below 10% and Cyperaceae pollen below 5% of  $\Sigma$ TLP. Towards the top of Wm-2 there is a decrease in the contribution of *Ulmus* and *Corylus*, and a slight increase in Gramineae, *Pteridium* and Filicales undiff.

### **Zone Wm-3 (108 to 55 cm) (*Tilia*-*Alnus*-*Corylus* zone)**

The base of Wm-3 is marked by a decline in *Ulmus* from over 5 to under 2.5% of  $\Sigma$ TLP and by an increase in *Alnus* pollen. The peak *Alnus* value of nearly 25% coincides with unit 4 of the sediment stratigraphy, characterised by a trough in LOI and higher carbonate content, perhaps indicating a phase when the local water table was higher, favouring alder, and increasing marl deposition. An increase in aquatic pollen types also suggests more areas of standing water on the Marley Wood fen during the time spanned by Wm-3. *Tilia* is the dominant arboreal type in the lower portion of this zone, although it does not attain as great an abundance as in Wm-2. *Corylus* is an important component throughout the zone (usually between 10 and 15%). In the middle of the zone *Tilia* pollen declines sharply, becoming rare from about 80 cm upwards. As *Tilia* declines,

*Alnus* becomes the most important arboreal type (usually between 10 and 20%). *Quercus* continues to make a small contribution to the arboreal sum, but *Ulmus* becomes increasingly rare through the zone. There are increases in Gramineae (including cereal type) and Cyperaceae; and other herbaceous types also become more frequent, including *Filipendula*, *Rumex*, *Plantago lanceolata* and Compositae Liguliflorae. *Pteridium* and Filicales spores also increase in abundance in the upper part of the zone, with Filicales peaking at about 30% of  $\Sigma$ TLP.

#### Zone Wm-4 (55 to 0 cm) (Gramineae zone)

This zone is characterised by a low abundance of tree and shrub pollen compared with herbaceous pollen. The base of the zone is delimited by a decline in *Alnus* to less than 2.5% of  $\Sigma$ TLP, and this decline is followed closely by a decline in *Corylus*. Contrary to expectations, *Alnus* pollen declines at a time when the LOI curve shows steady decline and the carbonate content curve shows a steady increase, suggesting a rising water table. The lower half of Wm-4 also features an increase in open-ground indicators, such as Compositae Liguliflorae-type pollen and *Pteridium* spores, and more frequent finds of cereal-type pollen. Despite the relatively low total contribution of arboreal pollen, a wide range of different types is represented, with increasing diversity towards the top of the zone. In the top half of Wm-4 there are also increases of Gramineae, *Filipendula* and *Equisetum* matched with decreases in Compositae Liguliflorae and *Pteridium*.

#### Discussion

Zone Wm-1 contains abundant *Pinus* pollen with a high proportion of Gramineae and Cyperaceae pollen, and therefore resembles early Holocene pollen assemblage zones from other sites in the Oxford region (Day, 1991; Parker, 1995; Parker and Anderson, 1996). For instance, a radiocarbon-dated pollen diagram from Cothill Fen, 7 km south west of Oxford, shows abundant *Pinus* pollen from c. 10,000 BP, with particularly high values (20 to 40%) from approximately 8,800 to 7,700  $^{14}\text{C}$  yr BP (Day, 1991). From this, in conjunction with abundant *Artemisia* and grass pollen early in this sequence, Day inferred that post-glacial woodland in the region began as relatively open parkland with *Betula* and *Pinus sylvestris* (Scots pine), with *Corylus* expanding c. 9400 BP. From around 9000 BP onwards, pine became less important in the Oxford region as oak and elm became established, although Scots pine woodland persisted longer than normal at Cothill, probably due to periodic woodland disturbance caused by Mesolithic people (Day, 1991). A similar pattern of woodland development is inferred in pollen diagrams from Minchery Farm, in south Oxford (Parker and Anderson, 1996), and from Spartum Fen, 15 km east

of Oxford (Parker, 1995, 2000).

The most distinctive feature of zone Wm-2 is the high abundance of *Tilia* compared with other arboreal types. While *Tilia* pollen is present in the mid-Holocene portions of the other pollen diagrams from the region, the Marley Wood fen displays remarkably high percentages. Within the region, only the pollen diagram from Sidlings Copse, 4 km north east of Oxford (Day, 1991), has comparable percentages peaking at around 30% of  $\Sigma$ TLP. The peak percentage of *Tilia* pollen found in Wm-2 compares with other high published values for *Tilia* in the British Isles, such as 56% of tree pollen found in peats near Cardiff (Hyde, 1936) and 69% of TLP recorded from Feltwell Common in Norfolk (Waller, 1988).

Despite moderate pollen productivity of *Tilia* compared with other trees (Moore *et al.*, 1991), the large, sticky pollen grains and timing of flowering in mid-summer result in relatively poor dispersal (Greig, 1982; Waller, 1994), and so it is often under-represented in pollen diagrams. Indeed, it has been argued that lime woodlands (dominated by *T. cordata* with some *T. platyphyllos*) were once much more extensive in England than the pollen records suggest (Baker *et al.*, 1978; Greig, 1982; Bennett, 1989; Waller, 1994). It has traditionally been thought that the natural, pre-clearance Holocene woodlands of England were mainly oak-dominated, with varying contributions of elm, lime, alder and other trees, depending upon edaphic, moisture and micro-climatic conditions. According to Greig (1982) this view long held sway because of the over-representation of *Quercus* pollen generally and because most of the deposits suitable for palaeoecological study in England happen to be located in areas of wetter and more acidic soils, where oak has a competitive advantage over lime.

The Marley Wood fen is an exception to this rule because of its hillside position in an area with well-drained limestones and sandstones. The pollen diagram indicates that lime was certainly the dominant mid-Holocene tree of Wytham Woods and its surrounds, and that elm, oak and alder were less important. Pollen studies from some other sites in southern England also highlight the former importance of lime (e.g. Barber and Clarke, 1987; Scaife, 1987; Waller and Hamilton, 2000). *Tilia* pollen begins its rise at about 170 cm within the sequence, probably at c. 6,800 BP, contemporaneous with the expansion of alder in wetter locations, by comparison with radiocarbon-dated pollen diagrams from elsewhere in the region (Day, 1991; Parker, 1995; Parker and Chambers, 1997). At the transition from Wm-2 to Wm-3, *Ulmus* declines and *Alnus* increases. The *Ulmus* pollen decline is clear and permanent, and therefore this horizon probably reflects the mid-Holocene elm decline of c. 5,100 BP that features in most pollen diagrams across the British Isles.

Following the elm decline, *Tilia* remains abundant, although at slightly lower percentages than before it. At around 80 cm, *Tilia* sharply declines and nearly disappears from the sequence. While *Alnus* pollen remains abundant, perhaps because of alder trees that grew around the margins of the fen, no other arboreal type replaces *Tilia* on the pollen diagram. Instead, there is an increase in Gramineae and ruderal pollen types. In conjunction with finds of cereal-type grasses from the elm decline onwards, the decline of *Tilia* can best be explained in terms of increased land-clearance for agriculture beginning in the Neolithic and accelerating in the Bronze Age. In the Sidlings Copse diagram, there is an initial decline in *Tilia* coeval with the elm decline (c. 5100 BP), followed by a second, permanent *Tilia* decline from c. 3,800 to 3,100 BP, attributed to increased land clearance. It is likely that the marked *Tilia* decline in the Marley Wood sequence coincides with the second phase of *Tilia* decline at Sidlings Copse (Day, 1991), and with woodland clearance at Spartum Fen c. 3,500 BP (Parker, 1995, 2000).

Following the *Tilia* decline, *Alnus* and *Corylus* remain abundant (between 10 and 20% of  $\Sigma$ TLP) until about 55 cm depth where both taxa decline at the transition from Wm-3 to Wm-4. The small contribution of arboreal pollen in this zone, compared with increased Gramineae and ruderal pollen, indicates more intensive clearance and land-use than at any previous stage within the sequence. Sidlings Copse features a decline in *Quercus*, *Alnus* and *Corylus* dated at  $1,820 \pm 80$  BP (OxA-2047) (Day, 1991), which might coincide with the Wm-3/Wm-4 transition. From at least medieval times onwards, parts of Wytham, including some of Marley Wood, were managed as wood pasture with widely-spaced trees and lots of grass. This could partly account for the low counts of arboreal pollen throughout Wm-4.

Although never achieving its former abundance, arboreal pollen becomes more diverse towards the top of the sequence, reflecting both regeneration and tree planting in Wytham Woods in more recent times. The present Wytham estate was part of the land owned by Abingdon Abbey until the dissolution of the monasteries in the 16<sup>th</sup> century (Grayson and Jones, 1955). Much of the tree regeneration and planting over the past two centuries is attributed to the Earls of Abingdon, who managed the area until the estate was sold in 1920 and later acquired by Oxford University in 1943 (Perrins, 1989). Today *Fraxinus excelsior*, *Acer pseudoplatinus*, *Fagus sylvatica*, *Quercus robur* and *Betula pendula* are abundant canopy formers in Wytham Woods, with *Corylus avellana* abundant in the understory. However, there is very little *Tilia* (Kirby *et al.*, 1996), and that which is present in tree surveys is solely planted *T. europaeus*, while *T. cordata* and *T. platyphyllos* are absent (Morecroft, unpublished ECN data). Despite the presence today of trees surrounding the



fen, the percentage of arboreal pollen remains low in the most recent samples compared with earlier in the sequence. This is probably because the regional pollen rain contains much less arboreal pollen than in pre-clearance times, and the arboreal contribution remains low in relation to the local input from the fen's grasses and sedges.

## Conclusions

This pollen study has provided the first long-term palaeoecological record from Wytham Woods. The conclusions can be summarised as follows:

1. By comparison with other pollen studies in the Oxford region, the abundant pine pollen in the basal zone of the sequence indicates that the Marley Wood fen contains sediment spanning most of the Holocene, from the present to at least 7,700 BP, and probably earlier. Given such a long record in an area generally devoid of suitable deposits for detailed palaeoecological study, it would be valuable to conduct higher-resolution analyses and to apply radiocarbon dating to the sequence.
2. The high values of *Tilia* in the mid-section of the sequence suggest that lime woodlands dominated the area for thousands of years before people began clearing the landscape for agriculture. The presence of the elm decline helps to date the sequence and shows that *Tilia* was at its height before c. 5,100 BP, but remained abundant for at least another thousand years. After the decline of *Tilia* and the later decline of *Alnus*, the amount of forest cover at Wytham (and in the Oxford area generally) reached a low point until efforts to regenerate and plant woodland were undertaken, mainly by the Earls of Abingdon in the 18<sup>th</sup> and 19<sup>th</sup> centuries. However, this did not result in the rejuvenation of *Tilia*.
3. Much of Wytham Woods are classed as ancient woodland, having stood since at least 1600 AD. However, despite the antiquity of Wytham Woods, the current mix of trees differs considerably from the pre-clearance, primary woodland that existed at and around the site during the mid-Holocene.

## Acknowledgements

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**Rebecca Hone**  
**School of Geography and the Environment**  
**University of Oxford**  
**Mansfield Road, Oxford OX1 3TB**

**David E. Anderson**  
**3 Carter House**  
**Eton College, Windsor**  
**BERKS SL4 6DG**

*and* **School of Geography and the Environment**  
**University of Oxford**

**Adrian G. Parker**  
**Geography Department**  
**Oxford Brookes University**  
**Gipsy Lane Campus**  
**Headington**  
**Oxford OX3 0BP**

**Michael D. Morecroft**  
**NERC Centre for Ecology and Hydrology**  
**University Field Laboratory**  
**Wytham**  
**Oxford OX2 8QJ**

## A CRITICAL ASSESSMENT OF 'A NEW GLACIAL STRATIGRAPHY FOR EASTERN ENGLAND' – A REPLY

Richard Hamblin, Brian Moorlock and Jim Rose

We were interested to read the response from Banham *et al.* (2001) to our paper in the October 2000 *Quaternary Newsletter* (Hamblin *et al.*, 2000). As they rightly suppose, we are preparing a full outline of our case for publication in a refereed journal, where we shall present all the evidence available. Our brief paper in *QN* was occasioned by the comments in the Norwich Field Meeting Report (Lawson and Allen, 2000) and the discussion during the April 2000 Annual Field meeting of the QRA, which took place before we had been able to complete the paper for publication. At this point we do not feel it would be practical to discuss the individual points raised by Banham *et al.* in view of the space required, other than to say that we would prefer readers to make their own judgement on the evidence available rather than 'urg[ing] colleagues ...not to adopt [our] new subdivision' (Banham *et al.*, 2000, p. 10). We would, however, like to express our disappointment with the tone of Banham *et al.*, which was at variance with the fruitful, open and challenging discussion experienced while presenting the evidence at the field meeting. The most important point we wish to make here is that the case presented by us is based on new evidence presented during the Norwich Field Meeting: the discovery of the unity of the Walcott and Lowestoft tills, which is based on detailed mapping as well as analyses, and the newly-established lithological relationship between the Happisburgh Till and a pre-Anglian deposit of the Bytham River at Leet Hill in southern Norfolk.

We reiterate that we are cautious about our proposed chronostratigraphy. We appreciate that there might be a conflict between our lithological evidence and the palaeontological evidence of the Sidestrand Unio Bed (Hamblin *et al.*, 2000, p.39), and also with the Trimmingham organic site, although we do not accept that the high *Hippophae* (Sea Buckthorn) at Trimmingham is overwhelming evidence of a Hoxnian age. There is certainly a problem with the ages of the Corton and Lowestoft formations: the presence of *Arvicola cantiana* in the Unio Bed underlying the Corton Formation apparently implies that the Corton is no older than Oxygen Isotope Stage (OIS) 12 (although see Vandenberghe (2000) for problems with equating the biostratigraphy with the oxygen isotope record), while Uranium Series data imply that the Lowestoft Formation is no younger than OIS 12. However, the evidence from the terrace deposits of the Bytham River demonstrates that the Corton and Lowestoft deposits cannot have resulted from the same glaciation, as the Anglian glaciation blocked, then destroyed the Bytham river valley system, and deposits at Leet Hill are not the



youngest Bytham deposits (Rose *et al.*, 1999) - hence our suggested chronostratigraphy. While we look forward to further dating evidence, we are surprised that Banham *et al.* should choose to dismiss our discovery of glacial materials similar to the Happisburgh Till in the terrace deposits of the Bytham river without having first studied the evidence.

Finally, we must take exception to the conclusions of Banham *et al.* that "we see no justification for...changing the term Cromer Diamicton" and that we should "retain the scheme of Lowestoft and North Sea Drift Formations" since the terms Cromer Diamicton and North Sea Drift Formation are wholly unacceptable in lithostratigraphic nomenclature. Cromer Diamicton is unacceptable because the geographical epithet "Cromer" is pre-empted by the Cromer Forest-Bed Formation. The application of the term Cromer Diamicton to Banham's Third Cromer Till is also confusing in view Banham's use of the epithet for all three of the tills in the local succession, and in view of the additional existence of the Cromerian chronostratigraphical stage, a state of confusion which is exacerbated by the presence of the Cromer Diamicton above the Cromer Forest-Bed Formation at the type locality of the Cromerian Stage at West Runton!

North Sea Drift Formation is unacceptable on two points. Firstly, the geographical epithet "North Sea" refers to the source of the components rather than to a site within the outcrop of the formation, and this is not an acceptable practice (e.g.: see North American Commission on Stratigraphic Nomenclature, 1983, p. 852). Secondly, whilst there is currently some discussion as to whether genetic instead of lithological qualifiers are acceptable for Quaternary formations, it is generally agreed that the term "Drift" is not acceptable. At a recent open Discussion Forum on Quaternary lithostratigraphy at Keyworth, Dr Gibbard spoke eloquently against the use of genetic epithets of any sort. Thus we recommend that the term North Sea Drift Formation should be dropped and that in future the term Corton Formation (Arthurton *et al.*, 1994) be used to include the Happisburgh Till and its associated outwash, and that our new term Overstrand Formation be used to include the Briton's Lane Sand and Gravel Member and its associated till. The Walcott Till becomes a member of the Lowestoft Formation.

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**Richard Hamblin**  
**British Geological Survey**  
**Keyworth**  
**Nottingham**  
**NG12 5GG**

**Brian Moorlock**  
**Department of Geography**  
**Royal Holloway**  
**University of London**  
**Egham**  
**Surrey**  
**TW20 0EX**

**Jim Rose**  
**Department of Geography**  
**Royal Holloway**  
**University of London**  
**Egham**  
**Surrey**  
**TW20 0EX**

With respect to Richard Hamblin and Brian Moorlock, this paper is published with the permission of the Director of the British Geological Survey, NERC.

## STRATIGRAPHY AND PALYNOLOGY AT HOXNE: A COMMENT ON GOSLING (2001)

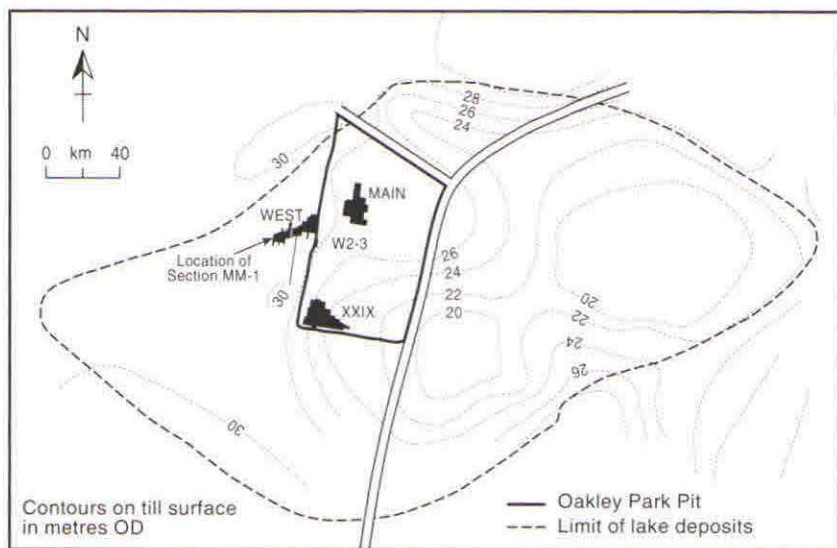
Nick Ashton and Simon Lewis

The recent palynological work by Gosling (2001) has highlighted some interesting questions about the complexity of the Upper Sequence at Hoxne, in particular the relationship between Stratum C (West, 1956) and Beds 4 and 5 of Singer *et al.* (1993). Gosling's work was based on two sections cut by Lewis *et al.* (2000) as the first stage in the Hoxne Dating Project, and visited by members of the QRA during the Annual Field Meeting in April 2000. It is the interpretation of the first of these sections (named MM-1 by Gosling) that requires clarification and further consideration.

Section MM-1 was revealed by removal of the backfill of the excavations in the 1970s (Singer *et al.*, 1993) and is located at the western end of their 'West Cuttings' in the field to the west of the Oakley Park Pit (Figure 1). Slight confusion has been caused because Gosling (2001, 28) refers to this as being 'just south of the Oakley Park Pit', but with a National Grid Reference (TM 1742 7665) that places it to the south west of the Oakley Park Pit. The correct NGR is TM 1741 7670.

The interpretation by Singer *et al.* (1993) of the deposits in the 'West Cuttings', was of Stratum E, overlain by Stratum C (the Lower Industry occurring at its base), followed by disturbed and mixed elements of the Upper Sequence (Beds 5-9) beneath topsoil. Towards the eastern end of the 'West Cuttings' a thin seam of Stratum D was also described. The identification of Strata E to C was based on a continuous series of sections that ran from the edge of the Oakley Park Pit to the western edge of the 'West Cuttings' (Singer *et al.* 1993), which is the location of Section MM-1. Section 100, described by West (1956, 277) in the edge of the Oakley Park Pit, on the eastern side of what were later to become the 'West Cuttings', was interpreted as containing Stratum C overlying Strata E, F and G.

Our own observations of this section (including Gosling's Section MM-1) gave little reason to disagree with these interpretations. Grey clay (*c.* 30cm), interpreted as part of Stratum E, was seen at the base. This was overlain by grey sandy silty clay (*c.* 70cm) with pockets of orange or grey sand, interpreted as Stratum C, and associated with artefacts that are part of the Lower Industry and a few fragments of bone. The overlying sediments consisted of clayey sands and sandy gravels with evidence of periglacial disturbance. Thus our interpretation, that the sediments in the 'West Cuttings' including Section MM-1, consist of Strata E and C, is consistent with that of earlier investigations.



**Figure 1.** Map of Hoxne showing position of areas excavated by Wymer (Singer *et al.*, 1993). Contours on till surface and outline of lake deposits after West (1956).

It should be noted here that Bed 4, although rather different in sedimentological character, was interpreted by Singer *et al.* (1993) as the lateral equivalent of Stratum C.

Gosling's interpretation of Section MM-1 is somewhat at variance with this. He has not identified Stratum E, which may have been rendered inaccessible by flooding of the base of the section, but has described and interpreted a light grey silt with pockets of orange sand as Bed 5 and the overlying sediments as Beds 6-8. The interpretation of the light grey silt as Bed 5 is based on the absence of clasts of brecciated clay-mud, a feature that West (1956, 285) describes as typical of that unit, and the similarity of the pollen content of this sediment to that recorded from Bed 5 in Profile F by Mullenders (1993) in the cuttings on the southern side of the Oakley Park Pit (Figure 1). In particular Gosling describes samples dominated by *Alnus-Poaceae* (alder-grass) with a rise in *Betula-Pinus* (birch-pine), a profile that is typical of the Hoxnian pollen zone Ho IVb.

The implications of these differences of interpretation are twofold. First, although West (1956) initially attributed Stratum C to Ho IV, reinterpretation by Turner (1970) based on work at Marks Tey, placed the lower part of Stratum C in Ho IIIb. Therefore either Gosling's zonation from the pollen is incorrect,

or West (1956) and Singer *et al.* (1993) have misinterpreted these sediments. Second, if Gosling is correct in his interpretation, then the relationship between the two archaeological industries is open to reinterpretation. According to Singer *et al.* (1993), there is a clear climatic and stratigraphic separation between the Lower and Upper Industries, the former occurring at the base of Stratum C, the latter at the top of Bed 5. The implications of Gosling's work are that both industries occur within Bed 5 and may therefore be more closely associated than has hitherto been thought.

What is clear is that there is a need for a thorough investigation of these problems, namely the exact stratigraphic relationship between Stratum C with Beds 4 and 5, and between the Lower and Upper Industries. The current project will focus on the stratigraphy, flora and fauna of these sediments and attempt to resolve these and other questions about this important Palaeolithic site.

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Nick Ashton  
Department of Prehistory and Early Europe  
British Museum  
Franks House  
38-46 Orsman Road  
London, N1 5QJ

Simon G Lewis  
Department of Geography  
Queen Mary, University of London  
Mile End Road  
London, E1 4NS



## STRATIGRAPHY AND PALYNOLOGY AT HOXNE: A REPLY TO ASHTON AND LEWIS (2001)

William D. Gosling

I am grateful for the comments made by N. Ashton and S.G. Lewis in this issue and thank them for the correction of the Grid Reference. However, I believe that this does not affect the interpretation of the sediments described in section MM-1 (Gosling, 2001). Gosling (2001) describes the sediments opened for the field meeting and reports pollen analyses. I agree with Ashton and Lewis that this investigation of Section MM-1 has raised questions regarding the relationship of the stratigraphic units in the upper sequence at Hoxne.

The description of Section MM-1 presented in Gosling (2001) does not show Stratum E because no sediments fitting the descriptions in West (1956) and Singer *et al.* (1993) were visible during the site visit. The base of Section MM-1 is also above the upper extent of the occurrence of Stratum E as reported by West (1956) and Singer *et al.* (1993). Flooding at the base of the section may have obscured some lower sediments.

The lower part of Section MM-1 consists of grey silt with pockets of orange sand; this unit has been correlated with Bed 5 based on sediment and pollen characteristics. The pollen assemblages described match pollen analysis by Mullenders (1993) for the pollen zones assigned. Supporting this, pollen assemblages from the matrix of the brecciated clay-mud of Stratum C (Gosling, 1999) do not match those obtained from the grey silts of Section MM-1. If these beds were laterally equivalent then a closer correlation may be expected. The dominance of fern spores, however, shows that these sediments have been extensively degraded. Therefore, pollen-based correlations should be viewed with caution.

I agree completely with Ashton and Lewis that further investigation into the relationships of these deposits is required. I thank them for the discussion and look forward with interest to the results of their research.

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**W.D. Gosling  
Low Latitude Research Group  
Department of Geography  
University of Leicester  
Leicester  
LE1 7RH**

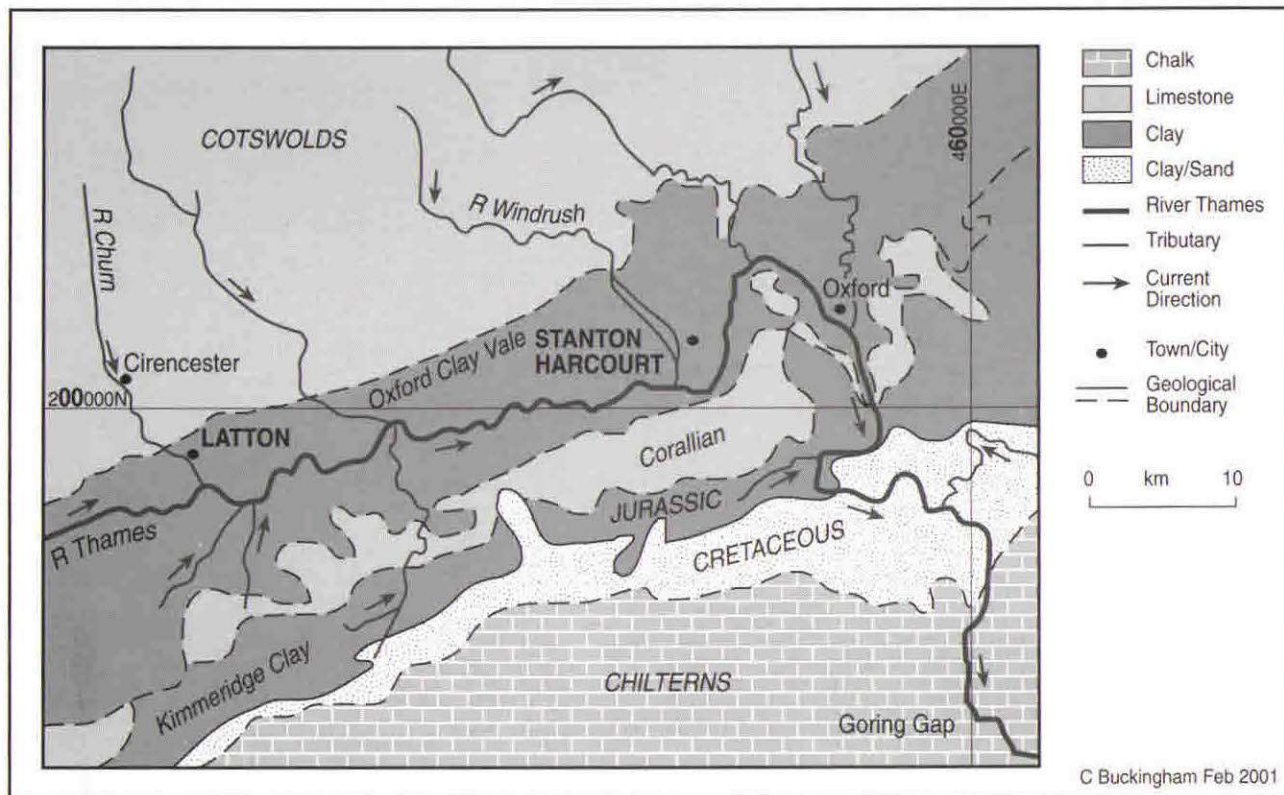
# REPORTS

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## PRELIMINARY REPORT ON THE EXCAVATION OF LATE MIDDLE PLEISTOCENE DEPOSITS AT LATTON, NEAR CIRENCESTER, GLOUCESTERSHIRE

Media interest in artefacts and mammoth remains found during gravel extraction at Latton, in the Upper Thames Valley, Gloucestershire (Figure 1), drew the authors' attention to this site at the end of 1999. 'Mammoth hunting and butchery during the Last Ice Age' had been reported in the press and a BBC documentary on the subject was being made. N. Hollingsworth (NERC) had collected numerous vertebrate teeth, bones and Palaeolithic artefacts from the basal gravels of the quarry and had suggested a mid-Devensian age for this material. On his invitation we visited the site and were shown various bones evidently still *in situ*. Apart from one mammoth tusk, which Hollingsworth had seen in the upper (quarried) gravel, all the vertebrate material and the artefacts came from a channel-like feature trending NE-SW across the quarry floor.

Our particular interest in this site arose from an examination of Hollingsworth's collection. We believed the mammoth (which dominated the large vertebrate fauna) to be a *pre*-Devensian type of woolly mammoth (*Mammuthus primigenius*) associated with temperate climatic conditions. This mammoth was first identified at Ilford in the mid-19<sup>th</sup> century (Adams, 1877-81) and was generally accepted to be of Last Interglacial age until Sutcliffe (1975) suggested a greater antiquity. Its particular characteristics are an overall body size about a third smaller than the Devensian mammoth and teeth which exhibit 'primitive' features, most notably a reduced lamellar (plate) frequency. It has been identified at a number of British sites attributed to Oxygen Isotope Stage (OIS) 7, and is commonly referred to in the literature as a mammoth of 'Ilford type' (Lister and Joysey, 1992; Schreve, 1997). The largest assemblage of this small mammoth is from our own excavations of the Stanton Harcourt Channel, 39 km east of Latton (Figure 1). More than 1,000 mammoth bones, teeth and tusks were recovered from Stanton Harcourt in association with other faunal and floral remains indicative of an interglacial environment (Buckingham *et al.*, 1996; Scott and Buckingham, 1997). It was of added interest, therefore, that the artefacts found at Latton Quarry are broadly similar, typologically and technically, to a number of those recovered from Stanton Harcourt (Derek Roe *pers.comm.*), although at neither site can a direct primary association be made between the artefacts and the bones. The Latton artefacts, which included Acheulian handaxes, were certainly unlikely to be of Devensian age.



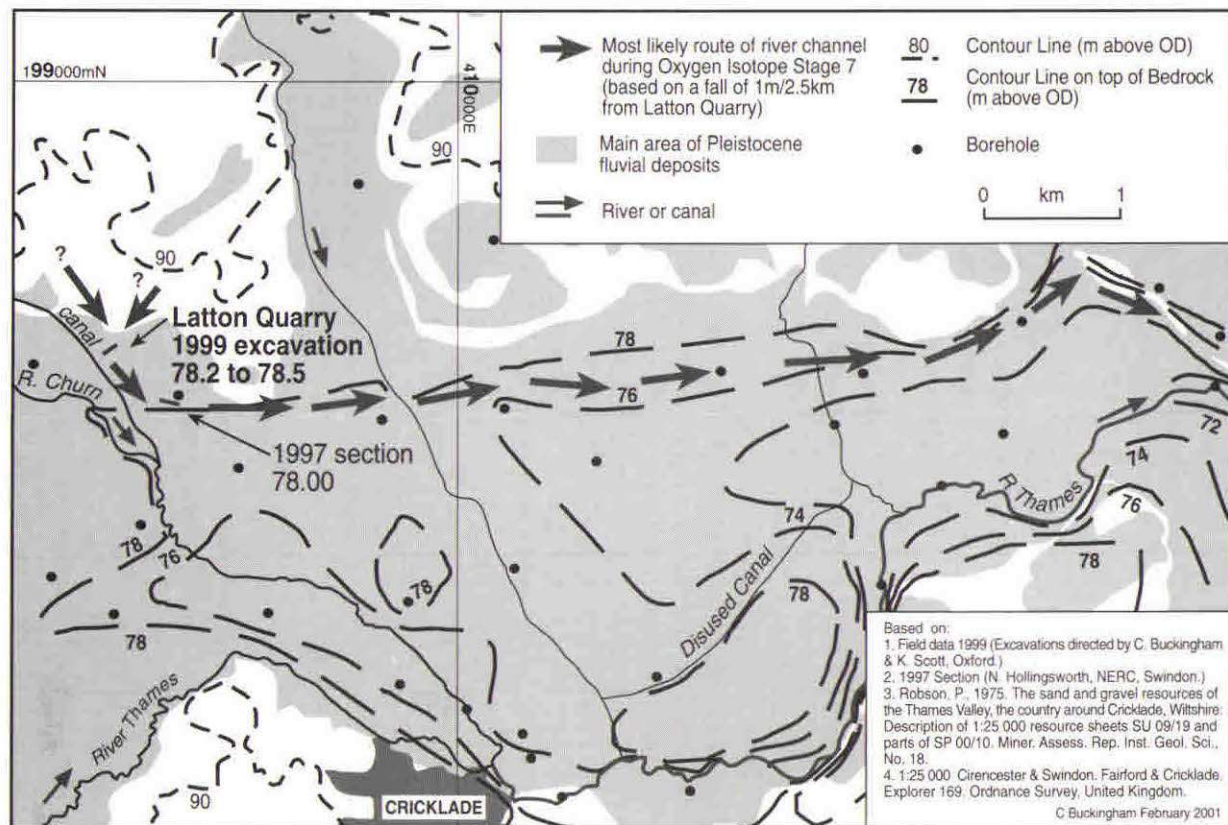
**Figure 1.** Simplified geological map showing the locatoin of Latton and Stanton Harcourt.

The possibility that the basal deposits at Latton might compare in age to those at Stanton Harcourt (i.e. some 200,000 rather than 60,000 years BP) led us to undertake fieldwork at Latton. Excavations were carried out between October and December 1999. Principally, we hoped to collect more artefacts and large mammal bones, and to recover plant remains, Mollusca and any other palaeoenvironmental data that might shed light on the comparability of Latton and Stanton Harcourt. We planned also to document the relationship of the fossil-bearing sediments to the bedrock, to determine whether the Latton deposits could be part of the same river system as those at Stanton Harcourt.

Prior to our fieldwork, D. Maddy and S.G. Lewis had included part of Latton Quarry in an extensive survey of the development of the Upper Thames valley during the last interglacial-glacial cycle. Local flooding at the time of their investigations prevented them from making a detailed record of the lower bone-bearing deposits although they recovered some large vertebrate remains, insects and molluscs from them. They accordingly concentrated their research on the main gravel body believed to be of Devensian age. During our own excavations, an organic horizon within these upper gravels was exposed and sampled by Lewis for specialist analysis (M. Field, G.R.Coope and D.Keen). As the results indicated cold-stage flora, Mollusca and Coleoptera, it is proposed that the entire stratigraphic sequence at Latton should be published in due course in collaboration with Maddy, Lewis and other specialists. The present interim report summarises our 1999 excavation of the lower gravels.

Of the one hundred large vertebrate remains recovered, two thirds were excavated *in situ*. The rest came from known localities but were excavated with a mechanical digger. Unfortunately, no more artefacts were found. Bulk samples were collected containing molluscs, insects and seeds, and a few pieces of wood were also retrieved. Initial observations indicate a fluvial deposit with some molluscs having warm-climate affinities, believed to equate with some part of OIS7 (D. Keen, *pers. comm.*). A notable feature of the large mammal fauna is that it consists entirely of the small form of mammoth and horse (*Equus ferus*). This is also true of both earlier collections of vertebrate remains from Latton (those of Hollingsworth and of Maddy and Lewis). Metrically and morphologically, the Latton bones and teeth resemble the remains from Stanton Harcourt and other OIS 7 sites: the mammoth is small and the teeth typically have a low lamellar frequency, which creates the impression of irregular, almost elephant-like patterning of the occlusal surfaces. The horse is the characteristically large late Middle Pleistocene form. However, the fact that there are only two species at Latton suggests a different local environment from that represented at Stanton Harcourt or, perhaps, a different phase of the interglacial. Our initial observations seem to substantiate both these suggestions:





**Figure 2.** The Upper Thames Valley, showing location of 1997 and 1999 observations at Latton.

the absence at Latton of straight-tusked elephant (*Palaeoloxodon antiquus*) and oak, both well represented at Stanton Harcourt, suggests a more open landscape at Latton, while the absence at Latton of the freshwater mollusc *Corbicula fluminalis* (Müller), very abundant at Stanton Harcourt, might indicate a cooler climate during the deposition of the Latton deposits.

As regards the possible topographical connection between the two sites, data from the Stanton Harcourt Channel deposits suggested that during OIS 7 the River Thames flowed in a direction similar to that of today, but that its position then was further north (Buckingham *et al.*, 1996). A similar situation would be expected at Latton if the basal deposits were roughly contemporaneous, but it would have to be possible for the water to flow downslope from the site in an east or north-east direction. The base of the fossil-bearing deposits at Latton was found to be between 78.20 - 78.50 m AOD. Assuming no differential uplift along the valley, the contours of the underlying bedrock below the main gravel at Latton, interpolated from boreholes (Robson 1975) and our own field data, suggest that it would indeed be feasible for the Latton channel to be an upstream tributary of the River Thames, probably a predecessor of the R. Churn (Figure 2). The river gradient would certainly have been steeper in its upper reaches, as the tributary flowed down the Cotswold dip slope, flattening as it joined the River Thames to flow east or north east, along the strike of the Oxford Clay vale, north of its current route. The interglacial 'channel' deposits at Stanton Harcourt occurred at approximately 63.00 - 64.00 m AOD. There would thus be a reasonable gradient from Latton to Stanton Harcourt, and so that the deposits could be broadly contemporaneous.

We conclude that the fauna and artefacts at Latton accumulated during OIS 7 but may represent a different climatic phase and/or local environment from the main bone-bearing deposit at Stanton Harcourt. We suggest that there are no major geological obstacles to the deposits at Latton being part of the same river system as those at Stanton Harcourt, whether or not the two occurrences are precisely contemporary.

### Acknowledgements

We are very grateful to the Quaternary Research Association and the Leakey Foundation for their swift response to an appeal for emergency funding, which made the excavation possible. Site access was kindly granted by Cotswolds Aggregates. We thank the many volunteers who helped at various times with the fieldwork, especially Sally Moyes who also conserved all the vertebrate remains. Sue Rowland provided cartographic assistance. We thank S.G. Lewis, D.A. Roe and D. Keen, D.C. Schreve and an anonymous referee for their helpful comments on the draft of this report.

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Katharine Scott and Christine Buckingham  
Donald Baden-Powell Quaternary Research Centre  
University of Oxford  
60 Banbury Road  
Oxford  
OX2 6PN

**REPORT ON THE FIRST UK WORKING GROUP MEETING  
OF INTERNATIONAL GEOLOGICAL CORRELATION  
PROGRAM (IGCP) PROJECT 437**

**“COASTAL ENVIRONMENTAL CHANGE DURING SEA-  
LEVEL HIGHSTANDS – A GLOBAL SYNTHESIS WITH  
IMPLICATIONS FOR MANAGEMENT OF FUTURE  
COASTAL CHANGE”**

**Institute of Materials  
London  
15-16<sup>th</sup> December 2000**

**Introduction**

IGCP Project 437 runs from 1999 to 2003 and the main aim is to explore the linkages between the last interglacial and Holocene highstand sequences and to relate this to coastal management. This rationale is defined by 6 objectives (summarised here): (i) to compare and contrast the evolution of coasts during the present Holocene sea-level highstand with earlier highstands (particularly OIS 5e), to provide data to inform contemporary coastal management decision making; (ii) to examine the global distribution of highstand shoreline successions for the Holocene and earlier highstands and explain the similarities and differences; (iii) to quantify the magnitude of sea-level variation during highstands; (iv) to develop and refine technologies for determining the age of coastal sequences; (v) to evaluate the impact of human activity in the coastal zone; and (vi) to synthesise the results through publication in scientific journals and disseminate the information widely (e.g. WWW).

This excellent meeting was the first conference for the UK working group – expertly organised by **Antony Long** and **Jane Sidell** and attended by an eclectic mix of 77 geographers, geologists, archaeologists and coastal-zone managers. The meeting was spread over 2 days, with day 1 devoted to 17 research papers and day 2 to a field excursion into the Thames lowlands.

**Friday 15<sup>th</sup> December**

The paper sessions were arranged thematically according to time-scale, from the present day to Holocene and previous interglacial times:

## Session 1 – Contemporary processes and coastal management

This first session considered contemporary processes and how these can assist understanding of past processes and coastal-zone management. The relationship between sources and sinks of sediment in the Greater Thames Estuary were examined by **Robert Nicholls**. Calculations suggest a 50% reduction in mud supply to the Thames since 1850 with the largest inputs apparently split equally between sediment derived from erosion of unconsolidated cliff material at the Isle of Sheppy and fluvial sources. This highlights the need for a judicious management strategy to maintain this balance in the future. **Bob Kirby** discussed sediment exchanges within two contrasting eroding muddy coastal systems – the Severn and Medway Estuaries – and the implications for management. The case was made for an integrated whole-system approach to the management of sedimentary systems with offshore subtidal dynamics. These observations, often overlooked, were argued to be an equally important consideration as coastal-zone processes operating at the top of the tidal frame. With traditional soft-engineering options such as set-back and saltmarsh inducement an inappropriate management strategy for large parts of both estuaries, the need for developing new technologies to maintain equilibrium shoreline profiles is essential. **Peter Murphy** explained the mitigation strategies placed in parallel with shoreline management plans conserving archaeological resources within the intertidal zone. Finally, **Cheng Zong** advocated the use of diatom-based transfer tidal-level functions from modern environments to enable more precise quantification of Holocene sea-level change changes.

## Session 2 – Late Holocene sea-level change

**Andy Haggart** opened the session with a reinterpretation of the seminal Thames sequence produced by **Bob Devoy**. Close examination of the biostratigraphic record shows that the Tilbury III peat may have formed during a period of positive sea-level tendency as biogenic sedimentation outpaced the rate of sea-level rise. Furthermore, a period of incision during the mid-Holocene is attributed to a fall in sea level by up to 3 m - a magnitude estimated by the depth of down-cutting of tidal channels. Such an assertion requires further testing from other sites in the region before tentative correlation with global climate change can be upheld. **Jane Sidell** presented an interesting paper explaining how archaeological structures (e.g. quaysides, wharves) buried in basal gravels have the potential to act as compaction-free sea-level index points with high-precision dendrochronological control. Archaeological data provide evidence for the migration of the tidal head upstream from Bronze Age times, and also indicate substantial changes in tidal range from the Roman period – a time when stratigraphic data are lacking. Recognising the effects of relative

sea-level change and tidal-range change during the last 2000 years is of fundamental importance to both geologists and archaeologists, but a greater understanding of the relationship between foreshore structures and former tide levels (indicative meaning) is required to reduce the large altitudinal uncertainty surrounding the data.

**Roland Gehrels** showed how the application of a foram-based transfer function can be used to establish high-resolution sea-level information from the coast of Maine, USA. Results of recent work show that using a chronology based on radiocarbon,  $^{210}\text{Pb}$ ,  $^{137}\text{Cs}$  and pollen age markers, sea-level fluctuations can be resolved during the last 1000 years which can be matched with Greenland ice-core temperature record. Most significant is a rapid rate of rise (c.0.5m) during the last 200 years – the fastest recorded rise in the last millennium. Finally, **Sue Dawson** argued the case for a link between climatic variables, storminess and the incidence of sand-blow events from Lewis in the Outer Hebrides. **Michael Tooley** questioned why there is no record of blown sand prior to the Little Ice Age, and **Bob Devoy** suggested that the mobilisation of sand could be linked with geomorphic thresholds and a change in the dynamic state of the dune barrier system.

### Session 3 - Mid-Holocene coastal evolution

**Simon Jennings** presented palaeoecological data from a site adjacent to a Bronze Age occupation platform at Shinewater, East Sussex. Pollen evidence showed the persistence of a fern-sedge fen environment during a suggested period of sea-level still-stand. The longevity of this habitat is attributed to a combination of grazing of the fen meadow and clearance of invading scrub woodland for purposes including trackway construction. **Jason Kirby** summarised the results of a PhD investigation covering the mid-Holocene evolution of the inner Humber estuary. Lithological and palaeoecological data from the lower Aire valley reveal a host of typical perimarine depositional environments such as freshwater carr, fen meadow, intertidal marshes and subtidal 'fluviolagoons'. Whilst sea-level change is seen to be the driving mechanism of environmental change in the inner estuary, tidal changes associated with changing estuary configuration and unquantified fluvial inputs hamper the resolution of the sea-level record. The significant gap in geographical coverage of sea-level index points from south-west England is soon to lessen after completion of a PhD thesis by **Tony Massey**. Tony presented the results from a back-barrier site in Devon where sea-level changes have been elucidated from foramineral data. Eventually, data from 3 sites will be used to obtain a sea-level chronology from which the validity of geophysical models of earth rheology can be tested.

The generally upward trends in relative sea-level recorded in these previous sites means that the mid-Holocene highstand sequences recorded in lower latitude environments are not evident. However, the last 2 papers in the session were from sites in the northern latitudes of the British Isles where contrasting isostatic history determines a different pattern of Holocene sea-level change. Evidence for a mid-Holocene highstand in the Solway Firth was presented by **Jerry Lloyd**. The Solway Firth represents a dividing isoline of crustal rebound, with the marine transgression being recorded 2 m higher on the north shore. Lastly, **David Smith** identified a 3-stage rise in sea-level during the Holocene, reconstructed from isostatically-uplifted sites in eastern Scotland.

#### **Session 4 – Interglacial relative sea-levels**

**Bob Devoy** showed how the familiar techniques of lithostratigraphy and micropalaeontology are equally applicable to pre-OIS 5e sediments as to their Holocene counterparts. Examination of an 18-m sedimentary sequence from Cork Harbour records the progressive marine inundation of the harbour during interglacial conditions. A 23-m east-west height differential between study sites which match in terms of lithostratigraphy and chronology (OIS 7?) is interpreted as evidence for neotectonism in the Late Quaternary, and may assist with dating of adjacent raised-beach features. **Helen Roe** described the evidence for pre-Holocene (Middle Pleistocene) sea-level change from buried estuarine sequences in the eastern Essex and North Sea region. The dominance of thick transgressive sequences representing only short periods of interglacial time, combined with the dearth of regressive event stratigraphy and problems with age determination, hamper attempts to elucidate precise sea-level reconstructions.

The uncertainty often surrounding the dating of Pleistocene sequences is a frequently recurring theme and, as such, is perhaps one of the most important areas for future IGCP research. **Martin Bates** outlined the complex sequence of raised deposits along the Sussex Hampshire corridor – including temperate sea-level highstand beach deposits at the classic Boxgrove site. Inconsistencies exist in the apparent age of these sequences compared to their relative elevation. Future work is aimed at establishing a better dating control so the sea-level history can be resolved. Lastly, **Dave Bridgland** and **Danielle Schreve** jointly summarised their work on the staircase of Middle Pleistocene Thames terrace deposits. Dave gave an informative overview of how these terraces (from three separate interglacials) relate to river change due to Quaternary climate change and set the scene for the field visit to Purfleet. Danielle described the results of faunal biostratigraphy, which was instrumental in



defining small-scale environmental and climatic changes within interglacial times. Evidence for marine incursions and influx of mammal species indicates a period of terrestrial reconnection to the mainland with important implications for sea-level history.

**Antony Long** summarised the day's papers with a salutary recommendation for the future of research to be multi-disciplinary and innovative – in order to develop new dating techniques to resolve many of the uncertainties regarding timing of events. A wine reception followed.

### **Saturday 16<sup>th</sup> December**

A smaller group gathered beside the Tate Modern, where the guided tour of the Thames lowlands began. **Gus Milne** explained how the relative position of river banks and archaeology (e.g. waterfront structures) has facilitated the estimation of changes in river course, tidal amplitude and the migration of the tidal head upriver since the Roman period. Moving downstream, we visited a submerged forest at Erith Marshes, where **Sophie Seel** gave a fascinating overview her PhD work detailing the composition of a late Neolithic/late Bronze Age yew-dominated woodland exposed on the foreshore (Figure 1). Extensive macrofossil analyses of the roots, stumps and trunks indicate the fascinating nature of Thames floodplain woodland during this time. Much discussion followed concerning the stratigraphic position of this remarkable exposure within the Thames sequence, the understanding of which is critical to any wider geoarchaeological or palaeoecological conclusions.

Whilst at Erith, **Martin Bates** discussed the contribution of geoarchaeological data to developing an integrated stratigraphic model for the Thames. Martin explained the importance of his work in developing an electronic database for storing and interrogating geoarchaeological information. This is an important future step not just in terms of the synthesis and public access of data, but also to assist strategies for locating archaeology and placing important archaeological data within a more sophisticated stratigraphic framework which recognises the complexity of a large evolving estuary. Such a system would benefit geologists, archaeologists, planners and developers and is thus of particular importance.

From Erith we crossed over to the north bank of the estuary to visit the classic Thames site at Tilbury, where **Bob Devoy** undertook in the 1970's his seminal work into the vegetational and land/sea-level movements. The group inspected a replica core taken by Antony and Jane from the original core site, and Bob treated us to a detailed description of it, discussing the environmental changes he had inferred in his original papers. Some discussion took place about



**Figure 1.** Quaternary scientists admiring a fallen Yew trunk in front of a clump of adventitious alder roots at Erith Marshes.

reinterpreting aspects of the stratigraphy, and Antony raised some pertinent points regarding broader-scale models of estuarine evolution. Everyone agreed that there is plenty of scope for further work in the Thames, particularly downstream of Tilbury.

The last stop was at Purfleet, in the lower Thames, where a sequence of interglacial sediments provides evidence for a high sea-level incursion. **Peter Allen** outlined the sedimentological characteristics of the (fresh/brackish water intertidal) deposits and highlighted the difficulties with defining depositional environments at the upstream limit of the tidal head. **Danielle Schreve** explained the contribution of her work on the biostratigraphy, which provides information for broader environmental reconstruction and age determination. Although the dating remains equivocal, the lack of species indicative of first post-Anglian interglacial times (Hoxnian) supports the assertion that Purfleet represents a type site for a second and younger post-Anglian temperate phase.

This ICCP meeting was laudable in many respects with particular emphasis on the mix of old and new ideas and the bringing together of different research communities. The research papers presented were all of a very high quality and the forum provided a useful platform for new researchers with fresh perspectives. Antony and Jane are to be congratulated for organising this conference so

successfully.

Copies of the abstracts and the comprehensive Field Guide (Sidell and Long, 2000), summarising past and present work in the Thames, can be obtained for £10 and are strongly recommended. Send cheques payable to the University of Durham to Antony Long, Department of Geography, South Road, Durham, DH1 3LE. Further information regarding the IGCP can be obtained from Antony and is available on the Web ([www.geography.dur.ac.uk/research/qec/igcp.html](http://www.geography.dur.ac.uk/research/qec/igcp.html)).

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**Jason Kirby**  
**Department of Geographical Sciences**  
**University of Plymouth**

### THIRD WORKSHOP OF *PALPEAT* - FUNGAL REMAINS (AND OTHER MICROFOSSILS) IN QUATERNARY PALAEOECOLOGY

Queen Mary, University of London, 10-11 January 2001

**Jeff Blackford** (QMW) welcomed the participants. The first session of the workshop introduced fungal ecology and the usefulness of non-pollen microfossils in elucidating past environmental changes. **Patricia Wiltshire** (UCL) reviewed aspects of fungal classification, reproduction, their natural function in ecosystems and their environmental requirements. **Roy Watling** (Edinburgh) detailed how mycological research is of vital importance if Quaternary scientists are going to name all the fungal spore types recognised down the microscope, but are unable to identify them to a specific family, genera or species. Furthermore, Roy outlined how modern mycological studies can provide details about important processes such as spore production and dispersal, which are vital for accurate interpretation of microfossil data. **Bas van Geel** (Amsterdam) outlined how fungal spores and other non-pollen microfossils can be used to reconstruct changes in mire hydrology and climate, and to identify phases of human-related disturbance. In particular, Bas has identified a number of indicator types that appear to be related to specific environmental changes.

Awareness of the procedures used to prepare samples for analysis is just as important as knowledge of fungal ecology. The next two speakers addressed some of these issues from an archaeological perspective. **Ciara Clarke** (Edinburgh) discussed how the choice of sample preparation technique can influence the recovery of fungal spores. Ciara assessed three processing techniques routinely used by pollen analysts and demonstrated that spore recovery varied. Interestingly, she suggested that the conventional HF/acetolysis method probably produced the best results for sediment collected from pasture, mor humus and a cow byre. **Andrew Hoare** (Edinburgh) discussed the difference in fungal preservation in soil located inside and outside a variety of archaeological monuments. This study suggested that there may well be unrecognised taphonomic problems.

Fungal macrofossil remains are also preserved in archaeological settings. Roy Watling described some of the finds, mainly puffballs, which he has come across. In certain cases there is reason to suggest that puffballs were deliberately collected, although the reason remains unclear. Roy suggested that one type of puffball, *Polyporus*, as found on the iceman corpse in the Ötztal Alps on the Austrian/Italian border, may have been used by our ancestors as an antibiotic.

Using fungal spores and other non-pollen microfossils as anthropogenic indicators was the dominant theme of several papers. Jeff Blackford, **Jim Innes** (QMW) and Ciara Clarke have used a near-modern analogue approach to identify fungal spores that are characteristic of human environments. Ciara discussed the types of fungal spores that were found in different agricultural contexts (e.g. organic hay fields, barns, stores). This research demonstrates that it is possible to identify specific agricultural activities from fungal spore data. Jeff and Jim presented the results of data analysed from surface and near-surface sediment samples collected from a variety of vegetational communities that they consider to represent near analogues of the kind of environments exploited by Mesolithic and Neolithic people. They hope this approach will provide data on the response of fungi and other zoological remains to activities such as grazing, burning and the opening of woodland. If a clear pattern can be discerned for an individual or suite of spores, they may be used to identify episodes of early prehistoric forest disturbance. To determine whether the near-analogue results are consistent with human disturbance episodes in early and mid-Holocene forests, Jim Innes discussed the fungal spore records from a number of sites, including North Gill and Bonfield Gill Head in the North Yorkshire Moors, Black Ridge Brook on Dartmoor and Moel-y-Gerddi in north-west Wales. Jim's results suggest that certain fungal spore types do respond to forest disturbance, although a consistent spore-type pattern was not always observed when comparing the data from all four sites. **Tim Mighall**, **Scott Timpany** and **Derek Thomas** (Coventry) continued this theme. Fungal spore data analysed from a lowland *Phragmites* peat close to Mount Gabriel on the Mizen Peninsula (Ireland) also suggested that an increase in certain types of fungal spores occur during phases of prehistoric forest clearance. However, no clear pattern in non-pollen microfossils could be discerned close to the Medieval iron bloomery of Llwyn Du in north-west Wales.

Finally, Jeff Blackford considered the usefulness of fungal spores as palaeohydrological indicators on mires and, by implication, proxy climatic indicators. Based on research conducted on ombrotrophic blanket peats in Ireland, north Wales and North Yorkshire, Jeff argued that certain fungal spores do appear to respond to changing mire surface wetness. Certain spores peak during dry shifts while others prefer much wetter conditions. By looking at the pattern of these fungal spores against other proxy methods of reconstructing Holocene climate changes (e.g. peat humification, testate amoebae), it may be possible to discern those fungi which are indirectly responding to climate change.

Time was also allocated for three workshop sessions to check identifications and to discuss ways of advancing this area of Quaternary research. Outcomes from these discussions centred on improving our ability to identify fungal and

other non-pollen palynomorphs routinely seen in samples prepared for pollen analysis. These included the possibility of a technical guide and to cultivate more links with mycological researchers. The meeting concluded with a vote of thanks to all the participants and especially to Jeff Blackford, Jim Innes and Patricia Wiltshire for such a well-organised workshop. At the start of the Workshop Bas van Geel, a pioneer in this field of research, had mentioned that in 25 years this was the first meeting he had attended that was devoted solely to fungal spores and other non-pollen microfossils in Quaternary research. Hopefully he will not have to wait that long for the next one!

**Tim Mighall**  
**Geography**  
**School of Science and the Environment**  
**Coventry University**  
**Priory Street**  
**Coventry**  
**CV1 5FB**

**For further details or information regarding future fungal spore events,  
please contact:**

**Jeff Blackford**  
[j.j.blackford@qmw.ac.uk](mailto:j.j.blackford@qmw.ac.uk)

## **NEW RESEARCH WORKERS AWARDS**

### **SEDIMENTATION OF THE BASAL DIAMICTON OF THE NORTH SEA DRIFT FORMATION, EAST ANGLIA, UK**

**Jonathan R. Lee**

**Department of Geography, Royal Holloway, University of London**

This report outlines ongoing research into the sedimentology and lithology of the glacial sediments of northern East Anglia. The report presents important new ideas concerning the paleogeography of the region during the Anglian glaciation. In addition, data and findings from this study were reported in the recent QRA field guide for Norfolk and Suffolk (Lee, 2000; Whiteman *et al.*, 2000) and presented during the 2000 Annual Meeting of the QRA at Norwich.

The sedimentology of the basal diamicton of the North Sea Drift Formation (Corton Diamicton), was investigated in this study at two coastal localities (see cover diagram) using standard sedimentary logging procedures supplemented by micromorphological analysis. This diamicton is widely considered to represent the first incursion of glacial ice (Scandinavian) into East Anglia during the early Middle Pleistocene Anglian glaciation (Lunkka, 1994; Bowen, 1999).

At Trimingham (TG 277 388), the Corton Diamicton was interpreted as being a subglacial deformation till produced by rapid till accretion adjacent to an ice margin. The glacial assemblage is represented by a vertical stack of tectonite and diamicton units exhibiting upward-increasing amounts of shear, homogenisation and inclusions of non-local material. At Corton (TM 546 972), the Corton Diamicton was interpreted as being of waterlain origin and a grounding-line location. The unit consists of alternate bands of contorted sandy outwash and rafts of subglacial till representing the remnants of a subaqueous grounding-line fan. Additionally, the composition of this debris fan, demonstrates the polythermal nature of the ice sheet with which it was associated.

This study has many important stratigraphic and palaeoenvironmental implications:

1. The recognition of a temporary grounding-line position within the geological record.
2. The recognition of lateral facies variability that is characteristic of many modern glacial environments.



3. The development of a palaeogeographic model which relates the Corton Diamicton to the Bytham river-terrace sequence and therefore enables a chronology to be attached to the unit. Evidence to support this model has since been found at Leet Hill (Rose *et al.*, 2000).

### Acknowledgements

QRA financial assistance towards the cost of two colour figures published in *Proceedings of the Geologists' Association* (Lee, 2001) is acknowledged.

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# **PALAEOENVIRONMENTAL RECONSTRUCTION OF A LOESS-PALAEOSOL SEQUENCE, PRIMORSKOYE, SW UKRAINE**

**Mark Stephens**

**Department of Geography, Royal Holloway University of London**

In 2000 I was invited by the Ukrainian and Moldovan Academies of Science to join an expedition from NW Ukraine, through Moldova south along the Dniester River valley to the Black Sea coast, east to Crimea and north along the Dnieper River valley to Kiev. The aim was to investigate many important Quaternary sections along the two river valley transects as part of a project to correlate the Middle Pleistocene stratigraphies of the glaciated regions of Poland (e.g. Krzyszkowski and Nita, 1995), Belarus and northern Ukraine (e.g. Nawrocki *et al.*, 1996), with those of the non-glaciated regions of Ukraine, and to correlate these with the global palaeoclimatic record. My own research was to investigate a loess-palaeosol sequence on the Dniester River transect.

Climatic and environmental change in SW Ukraine has been investigated from sediment and soil structures, grain-size distributions, mineral magnetics, sediment and soil chemistry. From the regional stratigraphy the geological time period covered is from Tiligul Loess (OIS 12) to Bug Loess (OIS 4) (Veklich *et al.*, 1967; Veklich and Sirenko, 1984). Climatic reconstruction in the region is based on the assumption that glacial epochs were associated with loess deposition due to strengthening of the Mongolian-Siberian high-pressure system and increased continentality, with subsequent increased aridity and storminess. Warmer epochs were characterised by soil formation in a moister environment caused by increasing influence of the westerly winds and local maritime influence of a full Black Sea rise.

Six loess units and five intervening palaeosols were identified. The lowest unit consists of Tiligul loess (OIS 12) with a rubified, Mediterranean-like, decalcified palaeosol developed within it (Zavadovka, OIS 11). This unit is truncated by a sandy unit grading upwards into Dnieper loess (OIS 6). This 3-m thick loess deposit contains a tundra gley palaeosol and is truncated by a 6-m loess deposit. The latter contains a leached chernozem (typical of sub-humid steppe) that represents evidence for two soil-forming periods within the Dnieper/Saalian loess (OIS 6) of interstadial or possibly interglacial status. Truncating the chernozem palaeosol is more Dnieper loess. This loess contains a calcified chernozem palaeosol (attributed to semi-arid steppe, similar to the present day) that is overlain by a very thin cover of loess and brown/chestnut calcified

palaeosol developed within it (typical of dry semi-arid steppe). This pedocomplex possibly represents the variation of the Last Interglacial (Kaydaki, OIS 5e) (Tsatskin *et al.*, 1998; Gerasimenko, 2001). Truncating this is Bug loess (OIS 4).

Non-gleyed soils exhibit an increased magnetic signal relative to the less weathered loess, while the tundra gley soil exhibits a very low signal attributed to degradation of magnetite grains by gleying processes. As a result, the use of magnetic susceptibility curves from areas such as Ukraine, as a global correlative tool with other regions with different soil processes, must be taken with care. It is suggested that increased intermittently wet/dry cycles are responsible for the magnetic signal of the palaeosols (after Maher, 1998).

### Acknowledgements

The fieldwork was carried out by myself, Dr. Darek Krzyszkowski (Cologne University; expedition leader), Dr. Andriy Ivchenko (Ukrainian Academy of Science) and Marek Majewski (Slupsk University, Poland). The Quaternary community will be saddened to hear about the sudden illness to Dr. Krzyszkowski whilst at the SEQS meeting in Bari, Italy. I understand that he is recovering slowly and I would like to express my appreciation for him and his work and also thank him for the hospitality he showed to me whilst on the expedition.

I would finally like to acknowledge the financial support of the QRA and The Geologists' Association, which contributed towards travel and subsistence costs. This work constitutes part of the MSc Quaternary Science University of London degree, based at RHUL and partly funded by an ECRC bursary (University College London).

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# BALGLASS: A FLAGSHIP SITE FOR THE QUATERNARY OF CENTRAL SCOTLAND

Eleanor Brown

Department of Geography, Royal Holloway, University of London

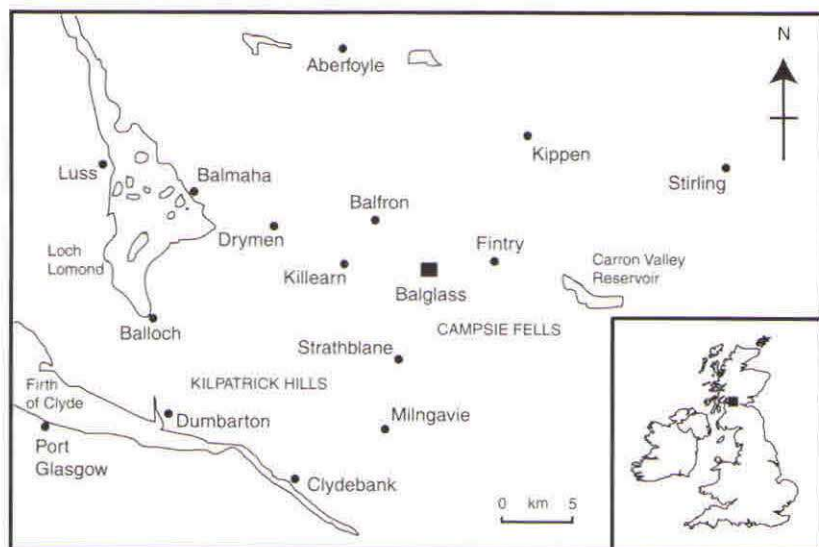
## Rationale

This research will attempt to address three significant challenges to Quaternary research in central Scotland. First, there is a limited insight into the Scottish landscape and climatic conditions before the Last Glacial Maximum (LGM) due to the paucity of locations where field evidence has survived erosion from the last Scottish ice sheet (Duller *et al.*, 1995). Such pre-LGM sediments are often difficult to date as they are often close to or beyond the limit of radiocarbon dating, making comparison of the terrestrial record with high resolution climatic records such as those contained within the Greenland ice cores a difficult challenge. Second, the many diamict facies within central Scotland present problems of definition and correlation, especially without a reliable geochronological framework. Finally, there is a need to conserve and manage relict Quaternary landforms and sediments for local communities, the wider public and for future Quaternary research. Therefore, interpreting the unique importance of Ice Age landscapes to non-specialists in an engaging and innovative manner is vital to ensure their future protection. The proposed Loch Lomond and the Trossachs National Park has great potential as an area in which to focus interpretation of Ice Age landscapes.

Recent investigations into the Quaternary stratigraphy of the Northern Campsie Fells, central Scotland, have revealed a complex sequence of glacial diamicts. Financial support from the Quaternary Research Association has provided an opportunity to (1) collect further field samples from these glacial diamicts, (2) fully excavate organic sediments situated within a drumlinised land surface and (3) assess the current provision of landscape interpretation within the boundaries of the proposed Loch Lomond and the Trossachs National Park.

## Methodology

Detailed field mapping and sedimentological analysis has been carried out at Balglass in the North Campsie Fells (Figure 1). The area lies outside the limit of the main Loch Lomond Readvance ice sheet as mapped by Rose (1981) and therefore there is the potential for preservation of both Devensian and pre-Late Devensian sediments. Facies description; sampling for clast lithological, particle-size and micromorphological analysis; palaeoecological sampling for pollen, coleopteran, molluscan and plant macrofossil analysis; and sampling



**Figure 1.** Location of Balglass in central Scotland.

for optically stimulated luminescence (OSL) and radiocarbon dating has been carried out.

### **Preliminary Results and Work in Progress**

Initial dating and palaeoecological results have confirmed the presence of pre-LGM sediments. They represent an arctic landscape and environment in central Scotland. The field investigation of the glacial diamicts suggests that the multiple facies are a result of different sources related to the local and regional geology. There is also evidence of tectonised bedrock, which may provide information on the build up of ice in the initial stages of the last glacial cycle. An assessment of landscape interpretation within the proposed national park has revealed the involvement of a variety of agencies, resulting in areas of overlap. There are further opportunities for increasing interpretation provision under the umbrella of the new national park authority. This research will develop a Quaternary interpretive plan for the proposed national park as well as outline key areas for future development in both Quaternary research and landscape interpretation. The challenge is on to enthuse the Quaternary scientists of the future by forging even stronger links between interpretation professionals, heritage managers and Quaternary scientists.

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# **REVIEWS**

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## **GEOLOGY FOR OUR DIVERSE ECONOMY: REPORT OF THE PROGRAMME DEVELOPMENT GROUP FOR ONSHORE GEOLOGICAL SURVEYS**

**G. Walton and M.K. Lee**

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In the spirit of glasnost the British Geological Survey has published a report of its onshore activities in Britain based on the needs of users and the strategic requirements for geological information. The report identifies a regional strategy to deliver this programme and highlights the vital need for more detailed information about the character and thickness of Quaternary deposits - something which is increasingly important for environmental assessments and developing sustainable resources, as well as in a wide range of planning issues. The overall programme will be delivered as a series of geologically coherent projects set within a regional framework, with an accelerated transition from systematic mapping to responsive revision of a three-dimensional database. However, the aim of producing digital models without the printout and recapture of data inherent in current mapping has its own dangers, since it could be much harder to spot errors on screen without printouts for proof-reading, which could also act as a backup in case of system failure. While the current series of 1:50,000 maps and sheet explanations will continue to be produced, the survey will aim to deliver new digital products for professional users, including GIS (Geographical Information Systems) formats, print-on-demand maps, and enhanced access to archival information.

The report contains a series of very informative regional overviews outlining the proposed programme and timetable for the next ten years, along with the projected output of maps and publications in each project area. Britain is divided into seven regions, subdivided into districts for the purposes of responsive mapping and revision outside the main programme, in order to meet

emerging user needs as they arise (e.g. temporary sections, major urban developments). To supplement this, there will be a three-year Quaternary methodologies and training programme run in collaboration with university specialists to improve the quality of Drift mapping and refine the description and interpretation of these deposits along the lines set out in the BGS consultation paper on Quaternary geology (see *Geoscientist*, 11, No.1, 14). This will be overseen by a Superficial Deposits Advisory Group which will also provide longer term guidance on such Quaternary matters, including the delineation of worked and disturbed ground such as former quarries along with landfill and other artificially made ground. In addition, the report provides an evaluation of every 1:50,000 sheet and lists those that remain in the present 15-year surveying programme and those that require revision by 2010. Unfortunately, this list does not state the date of the last Solid or Drift surveys for each sheet and thus gives the false impression that gaps will remain in the basic coverage of Britain: a number of sheets (e.g. Buckingham: 219) must have been recently completed and are yet to appear even as electrostatic printouts, while other sheets have only been published as provisional editions.

Clearly a lot of thought has gone into this carefully-budgeted report. However, in the last ten years staff expenditure has fallen by 44% in real terms and now stands at under £2 million a year for the onshore survey. Hence this proposed schedule must be thrown into some doubt. Indeed, the output of 1:50,000 maps only remained on schedule after the present 15-year mapping programme was extended twice, due to (1) significant efficiency gains, (2) the adoption of closely-targeted mapping instead of full resurveys and (3) the introduction of shorter Sheet Explanations instead of memoirs (see *Geology Today*, 16, 172-4). But there is a danger that such cuts will begin critically to affect overall efficiency: for the first time since 1835, when the survey was founded, nine scientists have been made compulsorily redundant (BGS Annual Report 1999-2000). Yet such an organisation needs a critical mass of well-motivated staff in order to be able to respond rapidly to future demands. In the long run the replacement of systematic mapping with responsive revision may prove costly, as a given area will be covered many times on an *ad hoc* basis without anyone necessarily having the time to produce a fully integrated geological interpretation of the landscape.

David Nowell  
2 Tudor Road  
New Barnet  
Herts  
EN5 5PA

# NOTICES

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## 1. BACK ISSUES OF THE BULLETIN OF THE NORFOLK GEOLOGICAL SOCIETY AND 50<sup>th</sup> JUBILEE SPECIAL VOLUME

QRA members might be interested to know that the Norfolk Geological Society has recently recovered back issues of the Bulletin that have until recently languished in Norwich Castle. As the Bulletin has published many papers of direct relevance to the East Anglian Quaternary, this is an excellent chance for individuals or institutions to complete runs. The Bulletin may not be easily available (except through inter-library loan), so you might consider a purchase for your institution library.

At present we can supply all issues except volumes 19, 32 and 42. Volumes 23, 27 and 28 are in short supply (less than 10 remaining). Note that volumes 1-10 and 11-18 are only available as reprint volumes 38A and 39A.

There are plenty of issues of the now famous East Anglian Geology issue (volume 34) - a must for Quaternarists!

In addition, the society has recently published a special volume (edited by Roger Dixon) to commemorate 50 years of the Society. This volume is dedicated to Brian Funnell and contains a number of articles about Brian, his research and the early days of the Society.

Back issues of the Bulletin are available at £3-50 per issue to GSN members and £10-00 per issue to non-members. If you want a lot of back issues it is cheaper to join the society (£10-00 per year) and buy them at member price.

The Jubilee Volume is free to GSN members. The remainder will be sold at cost (£8-50).

Sales will be made on a first-come-first-served basis.

If you would like to place an order, please discuss your requirements with Julian Andrews at UEA, preferably on the following e-mail address: [j.andrews@uea.ac.uk](mailto:j.andrews@uea.ac.uk)

Or by post:

Dr. Julian E. Andrews  
School of Environmental Sciences  
University of East Anglia  
Norwich, NR4 7TJ, UK

## **2. ACHIEVING CLIMATE PREDICTABILITY USING PALEOCLIMATE DATA**

### **EUROCONFERENCE ON ABRUPT CLIMATE CHANGE DYNAMICS**

**Castelvecchio Pascoli, Italy, 10-15 November 2001**

Supported by the European Commission, Research DG, Human Potential Programme, High-Level Scientific Conferences

With the growing awareness that the Earth's climate system can shift abruptly, without warning, from one climate state to another, comes the imperative to develop the scientific understanding needed to anticipate future climate "surprises". Although the meeting will include some consideration of large glacial events, the primary focus will be on "warm climate" (interglacial) abrupt change. The paleoclimate record makes it clear that abrupt climate shifts known to have occurred in the 20<sup>th</sup> century are only a subset of possible surprise climate system behaviours that have occurred in the more distant past and might be expected to occur in the future. The goals of the meeting are to summarize the state-of-the-art and to guide efforts to answer priority questions about abrupt climate-change dynamics.

The conference is open to researchers world-wide, from both industry or academia. Participation will be limited to 100. The emphasis will be on discussion about new developments. Grants will be available, in particular for nationals from EU or Associated States under 35. Additional funding from PAGES will also be available for participants from Eastern Europe and the former Soviet Union, Africa, Asia and South America.

Deadline for applications: July 2001

For information and application forms, contact:

**Dr J. Hendekovic**

**European Science Foundation**

**1 quai Lezay-Marnésia**

**67080 Strasbourg Cedex**

**France**

**Tel: +33 388 767135**

**Fax: +33 388 366987**

**E-mail: [euresco@esf.org](mailto:euresco@esf.org)**

On-line information and application on WWW at:

**<http://www.esf.org/euresco>**

### **3.**

### **TECHNICAL GUIDES**

Due to the successful completion and publication of Technical Guides 7, 8 and 9, the Executive Committee of the QRA is now seeking to commission new Technical Guides. Suggested topics can be completely new, or in the light of methodological and technological advances, revisit topics considered in earlier Technical Guides. If you could suggest a topic for consideration and edit a Technical Guide, please contact the Publication's Secretary in the first instance.

**Dr Andy J. Howard**  
**School of Geography**  
**The University of Leeds**  
**Leeds**  
**LS2 9JT**  
**Tel +44 (0)113 233 3345**  
**a.howard@geog.leeds.ac.uk**

### **4. FOURTH UK RIGS CONFERENCE & THIRD UKRIGS AGM**

**‘UPON THIS ROCK’: RIGS AND THE PLANNING SYSTEM**  
**13-15 SEPTEMBER 2001**  
**STOKE ROCHFORD HALL, NEAR PETERBOROUGH**

Contact:  
**UKRIGS Geoconservation Association**  
**c/o The Kiln**  
**Mather Road**  
**Newark**  
**Nottinghamshire**  
**NG24 1WT**  
**Tel. 01636 670046**  
**www.ukrigs.org.uk**  
**e-mail: rigs@rsnc.cix.co.uk**

## 5. JOURNAL OF QUATERNARY SCIENCE

### Forthcoming Research Papers

Khatwa and Tulaczyk. Microstructural interpretations of modern and Quaternary subglacially deformed sediments: the relative role of parent material and subglacial processes

Lyså and Lønne. Moraine development at a small high-arctic valley glacier: Rieperbreen, Svalbard

Bridgland *et al.* Middle Pleistocene interglacial deposits at Barling, Essex, UK: evidence for a longer chronology for the Thames Terrace sequence

Xiong *et al.* The climatic implications of loess deposits from the Beijing region

Licciardi. Chronology of latest Pleistocene lake-level fluctuations in the pluvial Lake Chewaucan basin, Oregon

Schoning *et al.* Marine conditions in Middle Sweden during the early Preboreal as inferred from a stable oxygen isotope gradient

Owen *et al.* Cosmogenic radionuclide dating of glacial landforms in the Lahul Himalaya, northern India: constraining the timing of Late Quaternary glaciation

McDougall. The geomorphological impact of Loch Lomond (Younger Dryas) Stadial plateau icefields in the central Lake District, northwest England

Montuire and Marcolini. Palaeoenvironmental significance of the mammalian faunas of Italy since the Pliocene

Bigg and Wadley. The origin and flux of icebergs released into the Last Glacial Maximum Northern Hemisphere Oceans: the impact of ice sheet topography

Turney *et al.* Elemental  $\delta^{13}\text{C}$  at Allen's Cave, Nullarbor Plain, Australia: assessing post-depositional disturbance and palaeoenvironmental reconstruction

Haldorsen *et al.* A Weichselian deglaciation model applied for the Early Permian glaciation in the northeast Karoo Basin, South Africa

Ponel *et al.* Lateglacial and Holocene high altitude environmental changes in Vallée des Merveilles (Alpes-Maritimes, France): coleopteran evidence

West *et al.* Evolution of a periglacial landscape in the Late Devensian: environments and palaeobotany of the Mepal area, Cambridgeshire, UK

**6. THE PLEISTOCENE WORLD - A TRIBUTE TO THE  
LATE DR LEWIS PENNY**

**JOINT MEETING OF THE YORKSHIRE GEOLOGICAL SOCIETY  
AND HULL GEOLOGICAL SOCIETY**

**13 October 2001, Geography Department, University of Hull,  
Cottingham Road, Hull, starting at 13:30**

Speakers:

- Professor John Neale - [introduction]
- Professor John Catt (UCL) - [Quaternary of Yorkshire / N. England]
- Professor Peter Worsley (Oxford) – “Interpreting Pleistocene palaeoclimates using relict permafrost structures”
- Dr Danielle Schreve (Royal Holloway) “Pleistocene mammals: a key to correlation”
- 4<sup>th</sup> speaker to be announced.

For more details contact:

**Mike Horne**

**e-mail: [mike@horne28.freemove.co.uk](mailto:mike@horne28.freemove.co.uk)**

**Tel: 01482 346784 (evenings)**

For updates and abstracts visit:

**<http://www.horne28.freemove.co.uk/hgabs.htm>**







## QUATERNARY RESEARCH ASSOCIATION

The Quaternary Research Association is an organisation comprising archaeologists, botanists, civil engineers, geographers, geologists, soil scientists, zoologists and others interested in research into the problems of the Quaternary. The majority of members reside in Great Britain, but membership also extends to most European countries, North America, Africa, Asia and Australasia. Membership (currently c. 1,000) is open to all interested in the objectives of the Association. The annual subscription is £15 with reduced rates (£5) for students and unwaged members and an Institutional rate of £25.

The main meetings of the Association are the Annual Field Meeting, usually lasting 3-4 days, in April, and a 1- or 2-day Discussion Meeting at the beginning of January. Additionally, there are Short Field Meetings in May and/or September, while Short Study Courses on techniques used in Quaternary work are also occasionally held. The publications of the Association are the *Quaternary Newsletter*, issued with the Association's *Circular* in February, June and October; the *Journal of Quaternary Science*, published in association with Wiley, incorporating *Quaternary Proceedings*, with eight issues per year, the Field Guide Series and the Technical Guide Series.

The Association is run by an Executive Committee elected at an Annual General Meeting held during the April Field Meeting. Current officers of the Association are:

- President:** *Professor M.J.C. Walker*, Department of Geography, University of Wales, Lampeter, Dyfed, SA48 7ED  
(e-mail: walker@lamp.ac.uk)
- Vice-President:** *Dr R.C. Preece*, Department of Zoology, University of Cambridge, Downing Street, Cambridge, CB2 3EJ  
(e-mail: r.c.preece@zoo.cam.ac.uk)
- Secretary:** *Dr C.A. Whiteman*, School of the Environment, University of Brighton, Cockcroft Building, Lewes Road, Brighton, BN2 4GJ  
(e-mail: C.A.Whiteman@brighton.ac.uk)
- Publications Secretary:** *Dr A.J. Howard*, School of Geography, University of Leeds, Woodhouse Lane, Leeds, LS2 9JT, West Yorkshire  
(e-mail: A.Howard@geography.leeds.ac.uk)
- Treasurer:** *Dr P. Allen*, 13 Churchgate, Cheshunt, Hertfordshire, EN8 9NB  
(e-mail: peter.allen6@virgin.net)
- Editor, Quaternary Newsletter:** *Dr J.B. Murton*, School of Chemistry, Physics and Environmental Science, University of Sussex, Falmer, Brighton, BN1 9QJ  
(e-mail: j.b.murton@sussex.ac.uk)
- Editor, Journal of Quaternary Science:** *Dr J.D. Scourse*, School of Ocean Sciences, University of Wales (Bangor), Menai Bridge, Anglesey, LL59 5EY  
(e-mail: j.scourse@bangor.ac.uk)
- Publicity Officer:** *Dr H. Binney*, Bloomsbury Institute of the Natural Environment, c/o Department of Geological Sciences, Kathleen Lonsdale Building, University College London, Gower Street, London, WC1E 6BT (e-mail: h.binney@ucl.ac.uk)

All questions regarding membership are dealt with by the **Secretary**, the Association's publications are sold by the **Publications Secretary** and all subscription matters are dealt with by the **Treasurer**.

QRA home page on the world wide web at: <http://www.qra.org.uk>



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