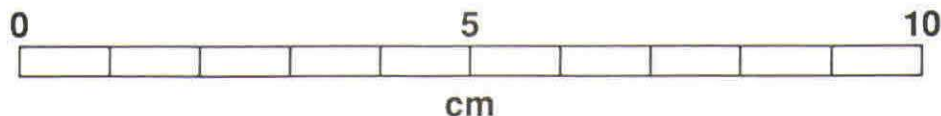


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# QUATERNARY NEWSLETTER

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## COVER PHOTOGRAPH:

Cone, resembling that of *Picea abies* ssp. *obovata*, found by F.M. Chambers in Facies IV (*sensu* Addison, 1990), Pen-y-Bryn, North Wales (see article in this issue). This was the largest cone discovered at the site.

# ARTICLES

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## DERIVING HOLOCENE PALAEOCLIMATES FROM PEAT STRATIGRAPHY: SOME MISCONCEPTIONS REGARDING THE SENSITIVITY AND CONTINUITY OF THE RECORD

Keith Barber

### Introduction

Changes in the stratigraphy of raised bog peats have long been used as a proxy-climatic record (see review in Barber, 1981). Recent attempts to refine and quantify this record are meeting with success, though there are still uncertainties and problems to be addressed. In recent conference papers and seminars I have been explaining the work on macrofossil and humification analyses which I have been engaged in with my co-workers Frank Chambers, Darrel Maddy and Rob Stoneman, and it has become clear to me from the questions asked and discussions afterwards that there are many in the Quaternary community harbouring a variety of misconceptions regarding the integrity of the peat record. I list below some of the commoner areas of concern and present evidence in favour of our case that there is a valuable and exploitable climatic signal in ombrotrophic peat.

### Allogenic and autogenic controls on peat growth

These concerns go back to the well-known theory of cyclic regeneration promulgated by Semander and Osvald in the early years of this century and popularised by Tansley (1939). In essence, this theory accepted the role of climate in the formation of major changes in bog stratigraphy known as recurrence surfaces, whereby dark highly-humified peat formed under relatively dry and / or warm conditions, was superseded by light coloured peat of low humification formed in a wetter and / or colder climate, but denied climatic influences any role in smaller scale changes. The vegetational and microtopographic mosaic of hummocks and hollows known as the regeneration complex was looked upon as a self-perpetuating autogenic system, even though the specifically stratigraphic evidence for this was very poor (Barber, 1981; Backeus, 1991). Private doubts, and tentatively phrased reservations such as that of Conway (1948), had little impact on this theory becoming the prevailing orthodoxy. Walker & Walker (1961) threw some doubt on its validity by failing to record any clear-cut cyclic changes in their study of the stratigraphy of

several Irish bogs, but my formal test of the theory (Barber, 1981) using macrofossil analyses of 21 profiles of peat at Bolton Fell Moss, Cumbria, and relating the stratigraphic changes to climatic variations determined independently by Lamb (1977) demonstrated that climate played a major role in peat formation. This conclusion, of the strength of allogenic forcing in peat formation, confirmed earlier work by Aaby (1976), and has been supported by Smith (1985), Wimble (1986) and Svensson (1988a, b), and the use of peat as a proxy-climate record has been extended to blanket bogs (Blackford and Chambers, 1991; Blackford, 1993). There remain problems connected with the replacement of once widespread species by others (Stoneman *et al.*, 1993), and, as with any biological proxy-data, there is a species signal to be accounted for (Van Geel & Middelorp, 1988; Johnson & Damman 1991), but progress is being made (Barber, *et al.*, 1994 in press). The much broader questions raised by Foster & Wright (1990) in their study of bog formation in central Sweden are outside of the scope of this short note, but it may be that autogenic factors are more important in more boreal regions with an excess of moisture, and I do not regard their allogenic and autogenic models as necessarily mutually exclusive.

### Pool size and permanency

The small hollows, typically 50 - 200 cm across, which are part of the natural undulating surface of Atlantic bogs such as Cors Caron (Tregaron) in Wales become small pools in times of higher water levels induced by periods of wetter climate. Such small pools can be traced in the stratigraphy of many bogs in the British Isles and adjacent parts of Europe and can be shown by stratigraphic analyses to be short-lived and often contemporaneous features of the bog surface, readily colonised by bog-mosses and converted into wet lawn or hollow (Barber, 1981; Wimble, 1986). They are quite different from the large pools present on Boreal / Continental bogs such as those described by Foster *et al.* (1988) in central Sweden and south-eastern Labrador, some of which may be more aptly described as ponds over 100 m in diameter and a metre or more in depth. These are semi-permanent features of these bogs which ... "have continuously developed on the mire surface as the mire has expanded outward. Any climatic control of pool initiation .... is not evident." (Foster *et al.*, 1988). Similar deep pools are present on the Silver Flowe bogs of Galloway (Boatman, 1983) where annual rainfall is in excess of 2,000 mm. The presence of such large pools all over a bog surface must to some extent act as a "buffer" to climatic changes - one would not expect to find a clear climate signal in their stratigraphy.

## Continuity and accumulation rates

Many peat stratigraphic studies in the period 1930 - 1975 concentrated on recurrence surfaces (Godwin, 1981; Barber, 1982) and attention was naturally focused on the most pronounced examples. Not surprisingly therefore a number of such surfaces produced radiocarbon dates from above and below the contact horizon that differed in age by 100 or more years, implying the cessation of peat accumulation for a while on the old dry peat surface, and a hiatus in the stratigraphy. However, many of these dates were from the period of the late Holocene plateau in the radiocarbon calibration curve which means that "... all periods between about 400 BC and 800 BC have more or less the same radiocarbon age." (Pilcher, 1991). Much of the argument in the 1960s and 1970s over the lack of synchronicity of recurrence surfaces in the same and in different bogs, as well as the presence or absence of a hiatus, can now be seen in this light. On the other hand, Wimble (1986), in a meticulously controlled analysis of a peat section from Foulshaw Moss in south Cumbria, involving macrofossil and pollen analyses as well as several radiocarbon dates either side of an older recurrence surface (3,200 BP), found no hiatus at all. Long radiocarbon date series, such as the 55 assays from Draved Mose, Denmark (Aaby & Tauber 1974) and the three Ulster sequences in Pilcher (1993), all display steady accumulation in what Clymo has characterised as "... a stately march through the millennia ..." (Clymo, 1991).

Raw accumulation rates, uncorrected for bulk density and calculated mainly from radiocarbon dated horizons, vary between about 3 and 50 yrs/cm (This expression is preferred to the more correct "mm/yr" as it relates to the common size of samples in palaeoecological studies, and because whole numbers are more easily appreciated). These are however the extremes and in various of European Atlantic raised bogs the average figure is around 10-15 yrs/cm (Barber *et al.* 1994, in press; Stoneman, 1993), a rate that allows for palaeoenvironmental reconstructions of high temporal resolution.

## Representativity of cores versus sections

It is obviously preferable in any stratigraphic study to be able to examine exposed sections rather than have to rely on boreholes. However there are practical problems with this approach on both untouched bogs where no sections are available, and due to new methods of peat extraction on damaged bogs. Whereas in the 1960s it was common to cut peat by hand, leaving the stratigraphy undamaged and open to view, the introduction of heavy tracked vehicles for ditch digging leads to distortion in the underlying peat on wet bogs,

and the use of the milling technique is even more destructive. Under this method large areas of bog have their vegetation removed and the peat surface is rotovated by machines; the drying peat is then bulldozed into heaps for removal. This leaves very few ditches to be examined on a bog being exploited by modern technology.

Multiple corings are clearly an option and a number of studies have proved their worth (Moore, 1977; Smart, 1982; Svensson 1988a, 1988b) but multiple profile macrofossil analyses are very time-consuming. Where they have been done, as in many of the studies cited above, they have shown a good degree of synchronicity of development especially in the late Holocene *Sphagnum* peats. We have relied on these results, and the replication of a limited number of cores from the adjacent mires of Bolton Fell Moss and Walton Moss in north Cumbria (Barber, 1993), in our work under the NERC Palaeoclimate Special Topic grant: *Spatial and temporal variability of Late Holocene palaeoclimates derived from peat stratigraphy* (Barber, Chambers & Maddy 1994, in press) and have analysed only a single core from each of five raised bogs in Ireland (2 sites), England, Denmark and Germany. The results show a number of consistent changes in macrofossil assemblages and we are confident that they represent typical changes in those particular bogs. It must also be noted that each core was taken from a present-day *Sphagnum* lawn situation and that the stratigraphy was checked carefully in the field for hiatuses. In addition we would point to the prevalence of a layered stratigraphy of only moderate relief in many Atlantic bogs examined by us and others in section (see, for example, plates 6.1 - 6.4, page 187 in Stoneman, 1993) - this "flat" stratigraphy is more useful and sensitive for climatic reconstruction than would be a stratigraphy dominated by climatically-insensitive hummocks.

### Species assemblages, changes and selective decay

Glaser (1992) has demonstrated that the bogs of eastern maritime North America have significantly more species than those of the continental interior and that climate, as well as age and landform type, is a factor in this. In Europe also the bogs of more oceanic regions are floristically richer (Overbeck, 1975; Moore, 1984) and this is expressed in the *Sphagnum* assemblages. This variety of species, each related to a specific niche controlled largely by water level, is very important in the registration of climatic changes. Bogs which are and have been for centuries dominated by a single species, or a section such as *Sphagnum* section *Acutifolia* which contains a number of species capable of living in a range of water levels, do not show the climatic sensitivity of sites such as Bolton Fell Moss where several *Sphagnum* taxa interact and take over from each other

as bog surface wetness changes in response to climate change. There is however a problem at this and many other sites in accounting for the local extinction of *Sphagnum imbricatum* over recent centuries (Stoneman *et al.*, 1993).

It is also vital that these changes in past assemblages are more or less faithfully recorded in the peat. There is good evidence for differential decay and loss of mass of the *Sphagnum* plants as they become part of the dead peat zone or catotelm of a bog, having grown in the surface layer or acrotelm (Clymo, 1983). However most retain a high degree of structural integrity, especially in lightly-humified peat, and these sub-fossils are recognisable to species or section level. This is vital for the reconstruction of the past bog community - the plant has lost mass, but if the leaf size and shape, and the diagnostic cellular details are still visible, then the original moss community can be reconstructed, albeit imperfectly. Selective decay may also exert an influence on bog microtopography, as pointed out by a number of ecologists including Johnson & Damman (1991). However, from the palaeoecological point of view this does not appear to be a great problem - former pools with *Sphagnum cuspidatum* are commonly seen next to low hummocks of *Sphagnum imbricatum* in their proper stratigraphical position.

### Sensitivity to climatic change

It would appear from our records that some bogs in some climatic regions are more sensitive to climatic shifts than others. This was demonstrated by Haslam (1987) who found that bogs in inland Germany and Poland had remained in a dry condition for millenia whereas those near the German coast and in Britain and Ireland showed frequent changes in humification and species assemblage. The reasons for differences between bogs in the same area are still being explored (Stoneman, 1993; Barber *et al.* 1994, in press) but local topography, the effects of sea-level changes on coastal bogs or the presence of adjacent lakes, and differences in the front of efflux from a bog - affecting its seepage rate and hydrological stability - are all factors to be considered. From the standpoint of reconstructing Holocene palaeoclimates we must clearly seek out sites that display sensitivity rather than complacency to climatic change, as advocated by Lowe (1993) in relation to isolating the climatic factors in Scottish woodland history. The bogs around the Solway area could be an ideal testing ground for the sensitivity of the bog record over a climate gradient as there are a number of raised and blanket bogs across a rainfall and temperature gradient from the Solway Firth to the Pennines.

## Conclusions

There will always be uncertainties and approximations associated with any method of environmental reconstruction which uses biological proxy-data, and the use of the peat stratigraphic record is no exception. Explicit recognition of the problems is the first step towards achieving a reliable and robust record and the palaeoecologist must have regard to the findings of ecologists working on the living system. It is also very much the case that the results of palaeoecological research can throw light on the workings of the ecosystem over long periods of time (Watts, 1973; Birks, 1986). It is in this light that the results of peat macrofossil and humification changes, and their relationship to climatic change, must be judged.

## Acknowledgements

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# SPRUCE, RESEMBLING *Picea obovata* Ledebour, FROM LATE-PLEISTOCENE DEPOSITS IN NORTH WALES

F.M. Chambers

## Introduction

### Late-Pleistocene record of *Picea*

Although not a Holocene native to either Britain or Ireland (Godwin, 1975; Moore, 1981), *Picea* (spruce) has been recorded from Quaternary deposits in the British Isles in previous temperate stages (Phillips, 1976; West, 1980a, 1980b, 1991). Its last known natural occurrence in Britain and in (Northern) Ireland is in the last cold stage (the Devensian in Britain; Midlandian in Ireland). In England, Devensian *Picea* has been recorded mainly from the Chelford interstadial, but also (tentatively) at a site in Gloucestershire (Wingmoor Farm) from deposits referred to the Upton Warren interstadial complex (Whitehead, 1990). Although in attempting to identify the Wingmoor Farm find, Whitehead (1990) made comparisons between his finds of sub-fossil bark and the bark of modern-day *Picea abies* (L.) Karst. (the Norway Spruce), previous research suggested that macrofossil finds of *Picea* from the Chelford interstadial were dissimilar from the Norway Spruce. Instead, they either resembled more closely the Siberian Spruce (Whitehead, 1977) - *Picea obovata* Ledeb., but listed in Flora Europaea (Tutin *et al.*, 1964) as *Picea abies* ssp. *obovata* (Ledeb.) Hulten - or were said to be intermediate in form between the Norway and Siberian spruces (Holyoak, 1983). Palynologists, too, have acknowledged that the "northern taxon, *P. abies* ssp. *obovata*" (Huntley and Birks, 1983) features in Early Devensian interstadial deposits (Phillips, 1976; Birks, 1978).

New evidence from a Late Pleistocene site in North Wales adds weight to the suggestion of similarity between present-day Siberian Spruce and Late Pleistocene macrofossils of *Picea* from Britain. The Welsh macrofossils also provide a geographical link between last cold-stage macrofossil finds of *Picea* at sites in England and in (Northern) Ireland.

### The site of Pen-y-Bryn

The Late Pleistocene site of Pen-y-bryn is located in the Seiont brickworks quarry (now owned and worked by Butterley Brick Ltd), 2 km south-east of Caernarfon, North Wales (Figure 1). Pen-y-bryn was originally described by Whittow and Ball (1970) as a site of glacial deposition, and as having tills

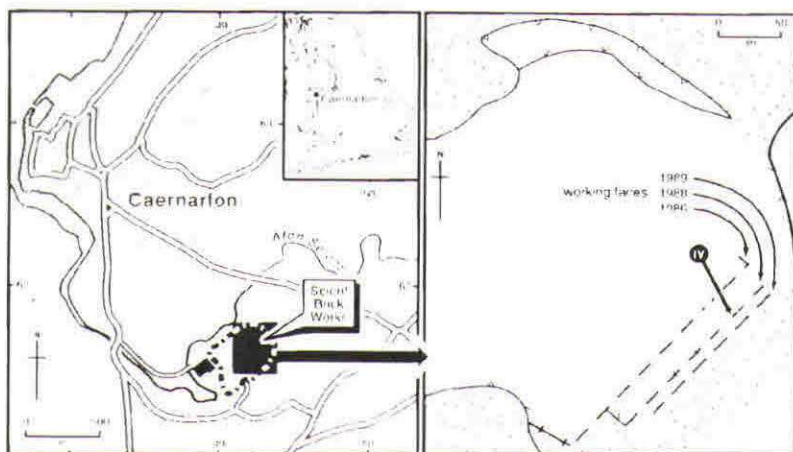


Figure 1. Map showing location of Pen-y-bryn site and original location of the cone finds in Facies IV (*sensu* Addison, 1990); re-drawn from an original in Addison and Edge (1992).

of Devensian age. Organic sediments were first discovered at the site by Dr Ken Addison and Martin Edge in 1986. Continued recession of the quarry face has since exposed further organic sediments beneath till of presumed Devensian age. The site and its deposits have been described in outline by Addison (1990) and in detail by Addison and Edge (1992). Preliminary palynological analyses were reported by Chambers (in Addison, 1990); further palynological analyses have been undertaken from five laterally discontinuous (but not necessarily five distinct) facies of biogenic deposits (Chambers *et al.*, in prep.); results suggest that at least two episodes of organic deposition had taken place, one of which was characterised by *Pinus-Picea-Betula* pollen. Sub-fossil Gymnosperm cones were found at Pen-y-bryn in Facies IV.

#### **Facies IV - the coniferous horizon**

Facies IV (*sensu* Addison, 1990) was described as "a 2-5 cm thick horizon of coniferous litter found in narrow, steep-sided [but shallow] bedrock channels" (Addison and Edge, 1992). The organic deposits comprising Facies IV were considered by Addison and Edge (1992) to be "still-water accumulations in shallow and probably abandoned fluvial channels". The deposits were "essentially *in situ*, at most sloughed off over a very short distance ... by sheet flow" (Addison and Edge, 1992).

The matrix of Facies IV has yielded pollen assemblages with relatively high arboreal pollen, comprising *Pinus* (35%), *Picea* (30%), *Betula* (6%) and *Salix* (1%) (Blackford, pers. com.; Chambers *et al.*, in prep.), indicating boreal woodland in the vicinity of the site.

### The cones

Significant amongst the matrix of degraded coniferous needles and small twigs in Facies IV were several gymnosperm cones. These cones were of two distinct morphological types. The smaller type was not well preserved. Despite the poor preservation, it is evident that these cones are not dissimilar from *Pinus sylvestris* L. - the Scots Pine - and are believed to be referable to that species. Specimens of the second type were larger, between 6 and 10 cm long and were relatively well preserved (see front cover). Though compressed by the weight of overlying sediments, which has had the effect of distorting their b- and c-axes, their length (a-axis) measurements are not considered to have been significantly altered since deposition. These cones are undoubtedly of *Picea*. Their size, at up to 95 mm in length, is intermediate between the reported modern size-range of cones of the Siberian Spruce - *Picea obovata* Ledeb. - and the Norway Spruce. All the non-*Pinus* cones found in the Facies IV deposits were referable to spruce and were closer to the size-range of modern material of Siberian Spruce (usually 5-8 cm); none was in the quoted size-range (12-15 cm) of modern Norway Spruce (*cf* Mitchell, 1974).

### Discussion

#### Taxonomy of *Picea*

Although arboriculturalists and foresters commonly make a clear distinction between the Norway Spruce (*Picea abies*) and the Siberian Spruce (*Picea obovata* Ledeb.) - regarded by Mitchell (1974) as the eastern counterpart of the Norway Spruce - *Picea* taxonomy has been a matter of dispute, with differences of interpretation as to whether the Norway and Siberian spruces should be regarded as separate species, or as sub-species of the same species (the Common Spruce), or as a cline (*Picea abies* agg.; *cf* Jalas and Suominen, 1973). The authors of *Flora Europaea* (Tutin *et al.*, 1964) appear to take the view that the two have the status of sub-species - *Picea abies* ssp. *abies* and *P. abies* ssp. *obovata* (Ledeb.) Hulten - though the latter is given as *Picea abies* ssp. *obovata* (Ledeb.) Domin in the *Atlas Florae Europaeae* (Jalas and Suominen, 1973). Hence, the 'Siberian' and 'Norway' spruces of common parlance could be regarded either as two geographical variants or as two sub-species of the

Common Spruce. All authors agree that among the principal distinguishing features between the so-called Norway and Siberian spruces - however they are defined taxonomically - are the size and morphology of the cones. The cones from Pen-y-bryn are closer in morphology to modern type material of Siberian Spruce *cf Picea abies* ssp. *obovata*, rather than of Norway Spruce, although they could be regarded as being of intermediate type.

### Age of the cones

Radiocarbon dating of the biogenic sediments at Pen-y-bryn proved problematic. The true age of some of the organic sediments appears to lie at or beyond the age limits of conventional radiocarbon dating. Samples were initially sent for radiocarbon dating from Facies I and III, but in view of conflicting results obtained from wood samples (not *Picea*) from Facies III, it was recognised that radiocarbon dating might only provide minimum ages for the deposits. Hence, because the results were likely to be misleading (*cf* Evin, 1990), no sample from Facies IV was radiocarbon dated (Addison, pers. com.).

The ages of organic sediments at Pen-y-bryn were estimated instead from (a) consideration of the fabric, origin and likely age of the overlying till (Addison and Edge, 1992), (b) biostratigraphic correlation of pollen spectra, and, subsequently, (c) uranium/thorium disequilibrium dating (*cf* Heijnis, 1992). The overlying till is believed to be of Devensian age (Addison and Edge, 1992). The close match between pollen spectra from Pen-y-bryn Facies III and IV with pollen spectra from Chelford, England, led Chambers (in Addison, 1990), Addison and Edge (1992) and Chambers *et al.* (in prep.) to propose a correlation with the so-called Chelford interstadial, now dated by thermoluminescence to 90-100,000 yr BP (Rendell *et al.*, 1991). According to Bowen *et al.* (1989), this would correlate with oxygen-isotope sub-stage 5c. Initial uranium/thorium disequilibrium dating of organics from Pen-y-bryn is also yielding results similar to those from other Early Devensian peats (Addison, pers. com.; *cf* Heijnis and van der Plicht, 1992).

### Other finds of subfossil *Picea* in the last cold stage in the British Isles

Substantial records of *Picea* cones have been reported from last-cold-stage deposits in both England (Holyoak, 1983) and Northern Ireland (McCabe *et al.*, 1987). Whitehead (1977) originally reported on the cones at Chelford, and was the first to point to their similarities with *Picea obovata* Ledeb. He describes the largest subfossil *Picea* cone he examined from Chelford as 90 mm in length

and as having broadly rounded and sub-entire cone scales - identical to those of modern-day *P. obovata*. McCabe *et al.* (1987) reported subfossil *Picea* cones at Aghnadarragh, Northern Ireland, identified as '*Picea abies* ssp. *obovata*(?)'. The similarities with the Pen-y-bryn material are remarkable.

Holyoak (1983), following Phillips (1976), measured the number of stomatal rows in '*Picea abies*' leaves from the sites of Brimpton, Berkshire (Bryant *et al.*, 1983) and Chelford, Cheshire, and found that the majority of leaves showed the number of rows believed to be characteristic of subspecies *obovata*, although some showed fewer - an observation that remained unexplained. Holyoak (1983) felt there was sufficient doubt as to the taxonomy of the Devensian *Picea* macrofossils at the sites he investigated that he raised the possibility of a taxon intermediate between the two subspecies of *P. abies*. One may note that in Poland, studies of recent and fossil cones, when combined with studies of recent pollen grains of *Picea*, imply the existence there of three morphological types (Ralska-Jasiewiczowa, 1983; *cf* Staszkievicz, 1966, 1976).

In the case of Pen-y-bryn samples taken by the author, the degraded state of leaves precluded reliable measurement, and so the evidence is confined to the morphological similarity of pollen (*cf* Birks, 1978) and of the morphology and relative size of cones compared with modern-day Norway Spruce and Siberian Spruce. However, the 'intermediate' nature of the cone sizes from Pen-y-bryn might interest those plant taxonomists and biogeographers concerned with the present-day overlapping ranges of sub-species of *P. abies*, because the Devensian data imply not merely very different ranges, but also the possibility of an intermediate taxon in the British Isles in the late Pleistocene (*cf* Holyoak, 1983). There might also be implications for West's (1980a) suggestion of a reduction in the range of 'biotypes' of *Picea* during (earlier) cold stages of the Quaternary. Reductions might have taken place more recently, in the Devensian: the evidence implies changes in the genotype, or in the range of ecotypes, within the last 100,000 years.

## Conclusions

The sub-fossil *Picea* cones from Pen-y-bryn resemble both modern cones of Siberian Spruce and the reported finds of sub-fossil *Picea* cones at Aghnadarragh, Northern Ireland, and some from Chelford, Cheshire. The size range of the cones is intermediate between quoted size ranges of Norway and Siberian spruces, but the cone morphology is more similar to modern-day Siberian Spruce (*Picea abies* ssp. *obovata*, syn. *Picea obovata* Ledeb.). Together with pollen and stratigraphic data, the cones from Pen-y-bryn indicate spruce



growing in boreal woodland in Britain during an interstadial of the last cold stage. The spruce cones may provide a geographical (spatial) link between that of the Early Midlandian interstadial described from Aghnadarragh, Northern Ireland, and with the Early Devensian pine-spruce woodland recorded at Chelford, England; however, further dating evidence is required before any temporal connections between the sites can be confirmed. The finds of similar *Picea* cones from last cold-stage sites in Northern Ireland, North Wales and England may have implications for taxonomists, biogeographers and palaeoecologists concerned with plant evolution, migration and extinction on sub-Quaternary timescales.

### Acknowledgements

Thanks are due to Martin Edge for drawing my attention to the site; to Dr Ken Addison and Martin Edge for collaborative fieldwork, sampling and for advice concerning radiocarbon and initial uranium-disequilibrium determinations; to Jeff Blackford for discussion of unpublished pollen data; to two referees for comments; to Andrew Lawrence for drawing Figure 1 and to Don Morris for photography.

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# RAPPORTEURS

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## AFEQ

Attempts are being made by the QRA to establish closer links with the other European Quaternary associations. It is hoped that such contacts will include, for instance, reciprocal assistance in the organisation of field excursions, details of activities in other countries for inclusion in Quaternary Newsletter, and so on. One of the first fruits of such contact is a field excursion to southern England by AFEQ (Association Française pour l'étude du Quaternaire) in May 1994, organised with the assistance of QRA members. I have received the following details of this excursion from M. Clet, Secretary of AFEQ (Editor):

The 1994 AFEQ field excursion will take place between 12th and 15th May in southern England.

The excursion starts in Portsmouth on 12th May.

### **Day 1 (12 May):**

- Boxgrove raised beach and palaeolithic site (leader: M. Roberts).
- Selsey and Brighton raised beaches (leader: D. Keen).

### **Day 2 (13th May):**

- Warren Hill and Beeches Pit Middle Pleistocene interglacial sites and palaeolithic archaeology (leaders: J. Wymer & R. Preece).
- Cromer Forest Bed at West Runton and associated glacial deposits (leaders: P. Gibbard & R. Preece).

Night in Norwich

### **Day 3 (14th May):**

- Sutton Knoll, Pliocene marine Crag: a Red Crag site (probably Buckanaye Farm) and Chillesford Church Pit: Lower Pleistocene fauna (leaders: J. Zalasiewicz & P. Gibbard)

Night in Norwich

### **Day 4 (15th May):**

- East Mersea interglacial sites (leaders: D. Bridgland & H. Roe).  
Possibly a visit to Kesgrave Gravels site if one is available.  
Return to Portsmouth via the Thames Estuary (Dartford Tunnel).

Limited to 36 participants.

Martine Clet., AFEQ Secretary  
Centre de Geomorphologie CNRS  
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# **OBITUARY**

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## **Richard William (BILL) Gale CARTER 1947-1993**

The sudden death of Bill Carter (47) after a short illness in July 1993 from cancer has deprived international coastal geomorphology of one of its leading luminaries. Bill was born in Bristol, and remained a west-country man to the end. He studied Geography for his first degree at Aberystwyth and graduated in 1968 winning the University of Wales Prize for Geography. He was then offered a chance to "do something geomorphological" by Frank Oldfield, at The New University of Ulster. Except for a brief excursion to London for a year, Bill remained there as postgraduate student (1968-71), lecturer (1972), senior lecturer (1981), reader (1987), professor (1991) and head of Environmental Studies (1989-92). His perceptive and transformational study of Magilligan Foreland for his doctoral thesis (1972) saw the foundations laid of his later coastal research; mesoscale approaches to morpho-sedimentary environments; the appreciation of shoreline development through morphodynamics; and the stimulus for his eolian work. It is no overstatement to say that Bill transformed coastal studies in Ireland. Before him, the coasts were regarded mostly as stratigraphical sections to aid interpretation of Quaternary sea-level movement. His realisation that the coastal stratigraphy and beach state had a process story to tell that was explicitly important for sea-level studies was witnessed by the string of publications in the 1970s and 1980s which identified these themes. He had a long standing interest in Quaternary scale coastal change, being a consistent contributor to the UK element of the IGCP61, 200 and 274 programmes (on sea-level curve and associated coastal development during the post-glacial and Holocene) and establishing the definitive post-glacial sea-level curve for Northern Ireland. He was a member of the Quaternary Research Association where he acquired the reputation as one of the few sea-level specialists who had a substantive appreciation of what coastal processes could and could not do! It was also through his interest in sea-level change that Bill took an active role in the Irish Quaternary Association, organising and running two of their annual field trips to Wexford (1981) and Londonderry (1986). Internationally, Bill extended his reputation with his innovative work on the Holocene development of the mixed sand and gravel barriers of south-east Ireland, as well as similar studies on the Holocene barriers of Nova Scotia. Much of the success in unravelling the bewildering variety of this coastline came from his incisive and

constantly fertile mind. However his world-wide reputation was fixed with his book "Coastal Environments" (1988) which stands as lasting evidence to his pertinence, incisiveness and comprehension of coastal studies. Much of his skill in coastal studies was his unerring ability to pull out the essence of any site and unite apparently disparate sites within an integrated and directed theme. On an individual basis, Bill was a professional to his finger-tips when it came to matters coastal. He often gave the appearance of being aloof and possibly cool towards others he did not know. This was because he had a shyness which he fought all the time. Bill was a glutton for work, his output was prodigious, somewhat in excess of 120 papers (with more in press and forthcoming) and four books in two decades plus a forthcoming IGCP274 volume on Models of Coastal Evolution. He will be professionally remembered as an outstanding worker, a selfless colleague and a firm friend of all who cared for the coast. On a personal basis, I shall remember him as a man of great humour, integrity and resolve. He will be sadly missed.

**Julian Orford**  
**School of Geosciences,**  
**The Queen's University of Belfast**

# REPORTS

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## PAST PRESIDENT JOHN WYMER D.SC.

John Wymer, the fourth President of the Quaternary Research Association (1975-77) was awarded the Honorary Degree of Doctor of Science of the University of Reading by the University Chancellor Lord Carrington, on December 11th 1993. The picture shows John in his robes with four Q.R.A. members (Figure 1). The Presenter was Professor Peter Worsley of the Postgraduate Research Institute for Sedimentology and his oration was as follows:-

"My Lord and Chancellor: It is, I believe, a great credit to this University that today I am able to present for an honorary degree someone who is indelibly associated with Reading Museum. Remarkably, the person concerned, my friend John Wymer, joined the payroll of the Reading Borough Council as archaeologist, without any formal qualification in that subject. By happy coincidence our new Vice Chancellor, Professor Roger Williams, has declared



Figure 1. John Wymer, past President of the QRA, receiving his Honorary Doctorate of Science from the University of Reading. From left to right: Roy Shephard-Thorne (himself a Reading Ph.D.), Peter Worsley (holding an Acheulian handaxe), John Wymer, Ian Fenwick and Les James.

that some priority should be given to strengthening the links between town and gown. Hence, it is particularly appropriate that today we can highlight the much acclaimed reopening of Reading Museum and honour its most distinguished associate.

No less than four departments of the University - Archaeology, Geography, History and Sedimentology, in combination spanning three faculties, have given their full endorsement to John's nomination for an honorary degree. Clearly, there stands before us a person who is no ordinary mortal, and I would like to elaborate a little on his background.

By chance John and I first met in Reading Museum late in 1966, just after he had resigned from his post there in order to work as a Research Associate for the University of Chicago. At that time, I was convener of a new interdisciplinary course in Quaternary science, designed to focus on environmental change during the last 2 million years or so. I had been tipped-off that a potential contributor, an archaeologist with significant experience of the Palaeolithic, might be there. And so he was, although I recall that he was rather reluctant to declare himself, since I suspect that his resignation had perhaps not gone down too well with the powers that be! However he gladly agreed to participate.

John's interests in the Quaternary were initially stimulated by his father the late B.O. Wymer, who was a commercial artist by profession and illustrated many of the popular comics of the day. Nevertheless, he was also an expert amateur archaeologist and geologist, with a passion for collecting flint artifacts. Curiously, these only attracted the interest of son John after his discharge from National Service with the Royal Air Force in 1949. With strong encouragement from his father, John embarked on a part-time, self-taught study of archaeology while employed successively as a journalist, audit clerk for British Railways and, finally, following a two-year training course, as a secondary school teacher in Wokingham. With his father, he made many forays to the rich array of sites in the Thames Valley where flint artifacts were to be discovered.

Within Quaternary science, the dividing line between Palaeolithic archaeology and Quaternary geology is difficult to place since they are necessarily symbiotic. Thus John rapidly matured as a geoarchaeologist, with a particular flare for sedimentology which, at that time, was at the embryonic stage of development. In the early 1950's he found that the detailed geology of his sites was virtually neglected, in part because such 'young' geology was not fashionable with the geological establishment which tended to regard the sediments containing the artifacts as 'the rubbish on top'. Accordingly he was obliged to master that



aspect himself. The family artistic talents had been inherited by John for his site records are works of art as are his drawings of the flint artifacts. Hence the illustrations in John's publications have his unmistakable hallmark.

The year 1955 was significant since it witnessed the commencement, by John and his father, and in their spare time, of a major investigation at Swanscombe near Dartford in Kent, where numerous flint implements had been extracted over many years. Swanscombe is a key locality for the history of human occupation of Britain, since one of the gravel pits there in the mid 1930's yielded two skull fragments. Shortly after the start of their work another skull fragment was discovered, and a report on this in the prestigious journal *Nature* formed John's first excursion into scientific publication. Astonishingly, the new fragment appeared to belong to the very same skull as the two fragments unearthed over 20 years earlier! These three skull fragments remain the oldest known human skeletal remains in these islands.

In the year after the start of the Swanscombe campaign came the appointment to Reading Museum and during the following decade enormous strides in the elucidation of the prehistoric archaeology of Berkshire came from a series of excavations, all directed by John.

His first task for the University of Chicago was to direct a number of excavations in South Africa before attention was once more focused on the British Palaeolithic, initially at Clacton on Sea in Essex and later at Hoxne in Suffolk. Hoxne is an evocative name in the history of archaeology, for it was here in the late eighteenth century that another John - John Frere - suggested that the flint handaxes dug from the brickpit there were 'weapons of war' from a time 'before the use of metals'. The results from five years exacting excavation at Hoxne has greatly clarified the relationship of the finds to geological history. This work was fully published just over a month ago, in a magnificent book coauthored with two Chicago colleagues. There can be no doubt that it will become a benchmark volume in Quaternary science, richly demonstrating the interdisciplinary character of the subject. It is of significance that during each of the five years work at Hoxne there were excavators from Reading.

This leads me to another dimension of John Wymer's influence on the quality of life in Reading. Excavation is necessarily labour intensive, and throughout his years at Reading Museum an eager body of helpers was attracted to John's magnetic leadership. In part, this was fostered by a series of joint University - Workers Education Association adult education classes in archaeology. As a participant in these, I can personally vouch for the enthusiasm which his

teaching generated. The tradition carried on even though the excavation sites were no longer in the local region, possibly aided by the knowledge that the director, as connoisseur of real ale, could be guaranteed to have a site in proximity to a pub supplying that vital beverage!

The work at Hoxne led to John making his home in rural East Anglia, and he has remained there ever since. After the Chicago fieldwork was completed in 1978, he worked until 1990 on a range of archaeological projects in that region as the field officer for prehistory at the Norfolk Archaeological Unit. For this present decade activity has switched to his old stamping ground in southern Britain, following his appointment as project leader of the 'Southern Rivers Palaeolithic Project', a major venture sponsored by English Heritage.

My Lord and Chancellor, John Wymer is a Quaternary scientist par excellence having authored five books and some sixty papers in the scholastic literature. I can assure you that members of the global Quaternary science community will rejoice that a university has given formal recognition to that fact. And there is to be found no more fitting university than this to bestow on him the title of doctor. It is a delight to present to you John James Wymer for the Honorary Degree of Doctor of Science."

## **YOUNG RESEARCH WORKERS AWARDS 1992**

**Reports from recipients of the Young Research Workers Awards  
in 1992, edited by Dr. G.S.P. Thomas:**

### **The Late-Pleistocene south coast of Ireland: sedimentation in a glacio-isostatically depressed peripheral basin**

**Colm o Cofaigh, Department of Geography, Trinity College, Dublin**

Controversy has arisen over the depositional origin of the shelly muds and associated raised beach deposits that occur along the south coast of Ireland from south Wexford to Cork. The QRA award was used to support a detailed lithofacies analysis and results indicate that the south coast sequences are the product of sedimentation in glaciomarine and arctic shallow water marine environments followed by a subsequent rapid emergence in a cold, periglacial setting. Sequences include coarse-grained periglacial gravity flows, glaciomarine muds, muddy diamicts, hummocky cross-stratified shallow marine sands and arctic beach-face gravels. The sequences preserve a record of on-lapping subaqueous deposition from the southern-most margin of the Late Devensian Irish Sea Ice Sheet. The presence of high sea-levels associated with full glacial conditions suggests that this was the result of glacio-isostatic depression beyond the margins of the Late Devensian Ice-Sheet.

### **Vegetation clearance in Northern Britain during Romano-British Times**

**Lisa Dumayne, Department of Geography, University of Southampton**

The following is the abstract of a paper presented at the 8th International Palynological Congress in Aix-en-Provence in September 1992 and supported by the QRA Young Research Workers Award.

Pollen diagrams from nine mire sites in the Anglo-Scottish Border region have been reconstructed to assess the record of human impact on vegetation over the last 3,000 years. Of particular interest is the effect of the Roman invasion and occupation of northern Britain on vegetation, especially that related to the construction of the Hadronic and Antonine Walls, forts and roads. Pollen analysis was undertaken to investigate whether the impact was widespread across the frontier zone or was related to the proximity to Roman Walls and forts.

## **Palynological and dendrochronological analyses of ancient and modern populations of mire-rooted *Pinus sylvestris***

Malcolm Grant, Environmental Research Centre,  
Department of Geography, University of Keele

A discrete layer of macrofossil remains at Whixall Moss represents some limited period of mire surface invasion by *Pinus sylvestris* in prehistory. Pollen, tree-ring and radiocarbon dating techniques have been used to determine the history of these trees and the cause and mechanisms of their death. Initial coarse sampling has produced a broad record of floristic change and subsequent analysis of contiguous samples is being undertaken to produce a detailed record of vegetational change in order to determine the longevity of the phase of occupation and the rate and dates for the decline of the mire-pine population. Attempts at cross-matching ring-width sequences from pine macro-fossils have been encouraging with a single floating chronology emerging. From this it will be possible to establish which trees grew contemporaneously and to investigate dynamic aspects of the pine population including germination and mortality trends, age structure, succession of the woodlands basal density and the impact of hydrological changes. The QRA Young Research Workers Award was used to offset field costs.

## **The formation of glacial bedforms: investigations at a fluted glacier margin, Breidamerkurjökull, Iceland**

Joanna V. Kidd, Department of Geography,  
Royal Holloway and Bedford New College, University of London

The QRA Young Research Workers Award was used to support field investigations at Briedamerkurjökull, Iceland. On the eastern side of the glacier a series of small flutes have been exposed by margin recession since 1987. The flutes ranged up to 60 cm wide, 15 cm high, and 20 cm in length, were of variable relief and appeared to have undergone extensive sub-aerial modification since being exposed. In the adjacent marginal zone of the glacier the surface was ribbed into parallel ridges of 30 m wavelength and 15 m height, but the flutes appear unrelated to them. On the western side of the glacier flutes are associated with a boulder obstruction and three types of flute could be identified; wedges, short, tapering flutes and long, parallel flutes. The short tapering flutes had sediment on both ice-proximal and ice-distal sides of the obstruction, but the other types had sediment restricted only to the ice-distal side.

## **Nature and origin of the palaeokarst phenomena of the Pleistocene calcareous sandrock of SW England and South Wales**

Iwona Morawiecka, Department of Geomorphology,  
University of Silesia, Poland

The award was used to support field investigations at eight Late Pleistocene raised beach sites on the coasts of Devon, Cornwall and Pembrokeshire where pipes are exposed in semi-lithified calcareous sandstone and arenaceous limestones. These sediments generally overlie a shore-platform and are themselves succeeded by decalcified sand, periglacial head, Holocene palaeosols and recent blown sand. A total of 400 pipes were measured. They vary widely in size but are usually cylindrical and vertical, ranging up to 3.5m in depth and 2m in diameter and often filled with sand or head-derived sediment. Field and laboratory analysis indicates that the pipes are true karst phenomena.

## REPORT ON THE 1993 QRA SHORT FIELD MEETING IN THE SHETLAND ISLES

10th - 13th September 1993

The participants gathered in Lerwick for the first day of what proved to be a highly successful and stimulating short field meeting. **Jacky Birnie's** first class organisational abilities ensured that the 20 plus members who had ventured this far north by air and sea were all met and delivered to the party as it moved from site to site.

The first day concentrated on the Lateglacial and Holocene history of the southern part of the Main Island. The first stop was just outside Lerwick and consisted of a brief visit to the Clickhimin Broch/Wheelhouse. The party then moved on to Aith Voe where **Jacky Birnie** outlined the sedimentary sequence at this site which recorded both Lateglacial Interstadial and Loch Lomond Stadial deposits. Discussion centred on the source of the Loch Lomond Stadial deposits and the possibility of a glacier being located in the catchment.

The discussion relating to the possibility of a Stadial glacier within the catchment continued at the next site, Burn of Mail, where **John Gordon** described the mounts and ridges in the valley which Peach and Home had proposed were moraines.

The final site before lunch was the famous Dalsetter erratic, a large block of Norwegian tonsbergite located in a field boundary. Despite its present location it is the only good evidence that the islands were once over-ridden by Scandinavian ice.

The first site in the afternoon was to the Jarlshof settlement near Sumburgh airport. **Valerie Turner** acted as our guide to this site where Bronze Age, Iron Age, and Norse remains are present in a complex set of structures which have been built and modified by later occupants. The party then drove northward to view St. Ninian's Tombola before moving on to the Lateglacial site at Clettnadal, West Burra. This former lake site lies near the top of a high cliff and in this scenic setting **Graeme Whittington** outlined the detailed research that has been undertaken on this newly identified site. The deposits stimulated considerable debate which ranged from the identification of *Salix* and *Betula* leaves to the origin of the capping breccia.

The second day dawned to grey overcast skies. The party travelled westwards from the St Magnus Bay Hotel at Hillswick to view the Houb, a double tombola which links the island of For a Ness to the Mainland. The group then travelled from the Mainland via two ferries and the island of Yell onto Unst, the northern

most inhabited island of the United Kingdom. Here **David Smith** and **Callum Firth** outlined the Holocene relative sea level changes that have occurred in this area. The first site, **Burrar** proved very wet underfoot, and up to the thigh for one participant. Despite **Callum Firth's** efforts with a gouge the stratigraphy proved hard to produce, but in the end everyone was satisfied that a number of marine layers were present in the well humified and poorly consolidated peat. After lunch **Callum Firth** and **David Smith** once again put the corer to work and this time clearly demonstrated a number of grey silty clay marine layers in the moss peat at **Norwick**. Discussion ensued relating to the significance in terms of storms of the fine sand layers within the peat. The party then drove to a view point where **Hugh Ross** outlined **Flinn's** evidence for an ice-dammed lake in the vicinity of **North Unst** and **Hugh** noted that his current research may result in a re-interpretation of the area.

On the return journey an unscheduled stop was made at the **Toft Ferry** site on the Mainland to investigate a buried soil that has been spotted by **Colin Ballantyne**. The site proved well worth the visit revealing a sequence of weathered bedrock, head, till (possibly flow till) and thin soil. It proved that there is still much to be studied in the Shetland Isles.

The final visit of the day consisted of a stop at **Garths Voe**, North Mainland to view a ditch section cut (an S.S.S.I.) into the blanket peat. **Jacky Birnie** outlined the palaeoenvironmental record of the site drawing particular attention to the layers of woody peat and the possible evidence of a bog burst. **David Smith** and **Callum Firth** then described the prominent sand layer in the section and suggested that it may be a tsunami deposit formed by the 3rd Storegga submarine land slide. The origin of the sand layer stimulated considerable debate which continued as the day came to a close. That night **Douglas Peacock** provided a brief outline of the Quaternary deposits lying offshore of the Shetlands and he noted that much work still remains to be accomplished.

On the third day the party initially travelled northwards first by minibus, then piled into jeeps and finally half an hour by foot to the 'interglacial' site at **Fugla Ness**. **Graeme Whittington** and **John Gordon** outlined the findings of recent research on the site. The most striking features of the section were the abundance of *Pinus sylvestris* stumps and roots. **Graeme Whittington** also noted that the site also contained *Bruckenthalia spiculifolia* pollen, a shrub today confined to the mountains of south east Europe. The vegetation thus certainly differs greatly from that known in the Shetland during the Holocene. The origin and provenance of the two till layers also spared considerable discussion.

The group then retraced its steps and after a brief lunch visited **Gunister Water** where **Keith Bennett** outlined the Holocene environmental history of the site.

From a very detailed analysis of lake sediments he suggested that *Quercus* and *Alnus glutinosa* trees would have grown on Shetland, indicating that the early Holocene woodlands were far more diverse in this area than previously proposed. He also suggested that the Shetland environment was drastically altered by society about 3,000 yrs BP but that the first impacts (fire) may have come far earlier at 8,600 yrs BP.

The party then made use of the final hours of daylight by climbing Ronas Hill, the highest on the island. As we passed up the hillside covered in relict and semi-active periglacial features **Colin Ballantyne** gave a running commentary on the formation of many of the features. The diversity of sites and rewards of research in Shetland were contained that night by a spectacular display of the aurora borealis across the clear Shetland sky.

The final day provided clear skies and autumn sun. After an hour's drive and a half hour walk along the deserted western coast of the Mainland the party came to the Sel Ayre interstadial site. The section is perched on top of spectacular 100m high Devonian sandstone cliffs. **John Gordon** had previously been hard at work with the spade to ensure the peat layers were well exposed. **John Gordon** and **Graeme Whittington** described the deposits at this site which consist of organic periglacial slope deposits overlain by till. Once again *Bruckenthalia spiculifolia* pollen was present in the peat layers. It is proposed that the site may record environmental changes from the Early to Late Devensian although further dating is requested to substantiate this view.

The party then moved onto the Scord of Brouster agricultural settlement where **Kevin Edwards** provided a brief outline of the establishment, growth and decline of this early agricultural site. Here debate centred on the relative importance of society and natural changes to the abandonment of the site.

At this point the party began to disintegrate as members began to make their way either to the airport or the ferry. The luckier ones remained on to visit the Lateglacial site at Tresta and the Holocene site at Murraster. What became evident over the four days was that the Shetland Isles contain a wealth of Quaternary deposits, landforms and artifacts. These distant islands have certainly attracted a wide range of Quaternary scientists and I am sure that they will agree that there is still much to learn from this area. The editors of the field guide are to be congratulated for a first class production and I would recommend its purchase to any member. Lastly **Jacky Birnie** should be congratulated in bringing the group together and ensuring that this excellent trip ran so smoothly.

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**REPORT ON THE IGCP PROJECT 274 FINAL PROJECT  
MEETING AND INTERNATIONAL SYMPOSIUM ON  
QUATERNARY COASTAL EVOLUTION: MODELS,  
PROCESSES AND LOCAL TO GLOBAL FACTORS**

**OOSDUINKERKE, BELGIUM**

**15th September - 18th September 1993**

"You should not be here!" were the opening words expressed by IGCP-274 Project Leader, **Orson van de Plassche** to delegates attending the eleventh international meeting and symposium of Project-174. This light-hearted reprimand reflected the fact that this was the second "final" meeting of the International Working Group of Project-274, following its one-year extension in 1992. However, two and a half days of papers, a half day field excursion, a business meeting, plus the generous hospitality organised by **Cecile Baeteman**, provided ample justification for our presence.

The primary objective of the meeting was to summarise the progress made over the past five years in terms of our knowledge and understanding of coastal and shelf evolution during the Quaternary, particularly over the past 300 to 200,000 years. In addition the meeting was to decide on the future international activities in the field of coastal and sea-level research under the auspices of IGCP or other programmes.

The international flavour of the conference was reflected by papers describing research from as far afield as Antarctica, China, Ghana and Morocco, to name but a few. This is not the place for a discussion of all the 39 papers presented at the Conference (**Baeteman 1993**), although perhaps two papers stood out in particular. The first, by **Julian Orford**, was dedicated to the memory of **Bill Carter**, who died earlier this year. The second was by **Yoko Ota** who presented an overview of her extensive work studying the evidence for coseismic uplift of Quaternary shorelines. Yoko is due to retire in the near future, and tribute was given by the Project Leader for her considerable contribution to Quaternary sea-level studies.

The business meeting was held on Saturday 18th September. **John Wehmiller** outlined the activities of the radiocarbon dating pool, and reported that 15 projects had received support. It was stressed that the success of the dating pool was based on the goodwill and co-operation of the relatively few number of participating laboratories. John Wehmiller was thanked for his efforts in managing this aspect of Project 274. **Colin Woodruffe** reported the final volume describing the results of Project 274 would hopefully be in press by the end of 1993. **Orson van de Plassche** noted that 16 papers had been offered for publication in a special issue of *Quaternary International* following the New Zealand conference, and hoped that a further publication would be forthcoming following the Belgium IGCP conference.

**Antony Long**  
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**REPORT ON PALAEOCLIMATE '93**  
**A JOINTLY SPONSORED MEETING BY THE QRA & NERC**  
**UNIVERSITY OF DURHAM**  
23rd-24th September 1993

Professors **B.M.Funnell** (UEA, Norwich) and **M.J. Tooley** (Durham) organised an open meeting at the University of Durham to present and discuss the results of the Palaeoclimate Special Topic 'Palaeoclimate of the Last Glacial-Interglacial Cycle'. This was, in many ways, a showcase meeting. The presence of Professor **J.C.Briden** (Earth Sciences Director, NERC) and Dr. **R.L.F. Kay** (NERC) emphasising the increased significance and importance of climate change research.

In 1989 the Earth Sciences Directorate established this Palaeoclimate Special Topic (PCST) under the guidance of the Palaeoclimatology Steering Group, chaired by Professor Funnell. A total of seventeen research grants, including six from outside the PCST, were awarded. The objectives of the PCST are numerous, but ultimately it is to improve the interpretation and modelling of past climatic change.

To what extent then, some three years after the first six awards were made, have these objectives been realised? Such questions, which must be increasingly addressed, cannot easily be answered and those who concern themselves with such issues are not to be envied! However, if the diversity and standard of the Durham presentations are anything to go by then this has been a very successful Special Topic indeed. Perhaps in recognition of this fact, further awards have been made through TIGGER - The Earth Sciences dimension to the Terrestrial Initiative in Global Environmental Research (TIGER) - to support collaborative palaeoclimatology.

The meeting began early on Thursday morning with a welcome and introduction from the organisers and it must have been most gratifying to greet an overflowing room of delegates, such was the response to this meeting. In view of the large number of presentations, I counted 47 during the two days (with nearly as many posters), thematic Plenary Sessions, parallel Supplementary Sessions, as well as Poster Sessions were no doubt essential. Abstracts from the Plenary lectures will be included in the next issue of the Newsletter

We began the Plenary Sessions with glaciers, glacial modelling and palaeoclimate. A presentation by **G.S.Boulton** and **A. Payne** (Edinburgh) examined changes in the European ice sheet through the last glacial cycle and was followed by a discussion of glaciers and climate from Patagonia, presented by **D.E.Sugden** (Edinburgh) and others. Glaciers, like the oceans, are remarkable bodies! Not only do they respond to climate change but, once they have grown sufficiently, they influence climate, attaining a highly dynamic state. Glacial

modelling can appear to be a highly complex procedure, yet it essentially aims to simplify the many interacting processes which link ice sheet dynamics and climate. These aspects of glacial modelling were further developed in the Supplementary Session on Glaciers and the talk by **N. Hulton** (Edinburgh), to name but one, clearly illustrated the relationship between ice sheets and climate in maritime mountains from South America.

Following on came lakes and palaeoclimate. Relatively new and powerful methods of water chemistry reconstruction were discussed by **S. Juggins** (London) and illustrated by diatom salinity transfer functions from North American saline lakes. Combined with additional multiproxy data from the same lake basins these reconstructions promise to yield exceptional insights into water chemistry development as a response to climate change. An excellent overview of research into tropical lake sediments by **F.A. Street-Perrott** (Oxford) emphasises the multidisciplinary research process. The associated Supplementary Session on Lakes coincided with the Glaciers and Dating Session which I attended, but the list of titles and geographical diversity of sites from Lough-na-Shade, Co. Armagh (**F. Oldfield** (Liverpool) and **J.A. Holmes** (London)) to the Middle Atlas, Morocco (**H.F. Lamb** (Aberystwyth) and others) to N.W. Mexico (**S.E. Metcalf** (Hull) and others), as well as talks by **E.Y. Haworth** (IFE, Ambleside) and others, **N. Cameron** (London), and **S.J. Brooks** (NHM, London) should have provided the audience with many excellent examples of applied palaeolimnology.

After a much needed coffee break the Plenary Sessions continued with a presentation by **K.E. Barber** (Southampton) and others on Holocene palaeoclimatic reconstructions based upon plant macrofossils and peat humification from raised bog sites. Again, the Supplementary Session on Peats the following afternoon clashed with the Loess Supplementary Session and I missed out on some of the detailed discussion regarding the interpretation of these data. However, I understand that the latter session stimulated much useful debate.

An overview of dating techniques applied to Late Holocene geochronology, tested upon both varved lake sediments and ombrotrophic peats from northern Sweden, were provided by **F. Oldfield** (Liverpool) and others in a talk entitled 'The chronology of the last Millennium'. Dating techniques, clearly so essential to palaeoclimate studies, often yield conflicting results. It was therefore encouraging to hear of the progress being made and of the attempts to compare the relative merits of various dating methods. The Supplementary Session presentation by **T.C. Liew** and **N.H. Gale** (Oxford) on U-Series dating of marine sediments promises an extended absolute timescale for the deep sea record if ongoing experiments provide improved extraction and detection techniques.

Lunch was followed by an address from Professor **J.C. Briden** (NERC) on the role of NERC and the Earth Sciences Directorate within palaeoclimate studies. He informs that technical reports from the Palaeoclimate Special Topic are now complete and should be published this spring. Working within a subject area which sometimes has no immediately apparent relevance to wealth creation, I was struck by the remark that in the future the criteria of relevance of research to wealth creation and quality of life will be factors in proposal evaluation alongside the existing criteria of excellence, intrinsic importance, and pervasiveness of likely influence of the proposed work. However, I am reliably informed that economic applicability has been taken into account by NERC for some considerable time.

Our final Plenary Session presentation of the afternoon came from **D.J. Beerling** (Sheffield) and others and dealt with 'Palaeoenvironmental information from Quaternary leaves'. This project has developed upon work by **F.I. Woodward** (Cambridge) which demonstrated a relationship between the stomatal density of terrestrial plants and global atmospheric CO<sub>2</sub> partial pressures. The combined measurement of  $\delta^{13}\text{C}$  and the frequency of stomata in fossil leaves theoretically has the potential to allow the reconstruction of temperature and carbon dioxide changes. In this respect, material which is being provided by **H.H. Birks** (Bergen) from a new, highly expanded Lateglacial site in western Norway should provide valuable fossil leaves to test these relationships.

A sherry reception and excellent dinner in Collingwood College provided a pleasant and relaxed setting for informal discussion. A festschrift volume with contributions from friends and colleagues was presented after dinner to Professor **A.G. Smith** from **J.R. Pilcher** (Belfast) and we were subsequently entertained by Professor Smith as he reminisced over his career and life. Sound advice to the married and partnered academics was don't take too much work home with you!

Friday was kick-started with a presentation of the IGBP 'PAGES' Core Project by **J.R. Pilcher** (Belfast). The day's first Plenary Session was on Loess and Palaeoclimate, with talks on the extensive loess-palaeosols of China by **B.A. Maher** (UEA, Norwich) and **E. Derbyshire** (London). Particularly noteworthy are the attempts to reconstruct palaeo-precipitation values across the loess plateau and the comparison of these values with those predicted by climate models.

Two very stimulating presentations followed in the Plenary Session relating tree rings and palaeoclimate. The annual stable isotopic records of British oak trees were presented by **A.M. Pollard** (Bradford) and some of the problems of interpreting the data were reported, particularly within intra-ring measurements.

Clearly, as the equally excellent poster presentations illustrated, this is an area of intense research effort and considerable future potential. I particularly enjoyed **K.R. Briffa's** (UEA, Norwich) presentation of tree-growth data from northern Sweden which included a discussion of the palaeoenvironmental and chronological implications of different tree-growth parameters within living and sub-fossil pines. His treatment of the problems associated with 'floating' chronologies was excellent.

Multi-proxy palaeoclimate analysis was the title given to the next Plenary Session and presentations by **G.R. Coope** (London) and **R.C. Preece** (Cambridge) dealt with the largely qualitative approaches employed to interpret such data. Presentations by **B. Huntley** (Durham), followed by **T.C. Atkinson** and **K. Sinka** (UEA, Norwich) were included in the Quantitative Palaeoclimate Reconstruction Plenary Session. I missed **Brian Huntley's** talk on pollen-climate response surfaces and although the talk on mutual range analysis by **T.C. Atkinson** provided convincing results when applied to herpetofaunas (amphibians and reptiles), it was apparent from the ensuing discussion that the techniques mentioned previously by **S. Juggins** (London) might provide a more rigorous statistical treatment of the data in question.

Concluding remarks were given by **B.M. Funnell** and **W.G. Chaloner** (London) earlier than expected on Friday as it became apparent that the afternoon sessions were running late. This had clearly been a successful Special Topic and the encouragement of the Palaeoclimatology Steering Group for individuals and research groups to collaborate was viewed as a positive and constructive initiative. The future, as the community moved forwards into the next Special Topic, TIGGER, was viewed positively by those within established research groups and by those willing actively to search out collaborative and multidisciplinary research projects.

This meeting clearly demonstrated the vitality and diversity of UK Quaternary research. Many of the projects presented clearly demonstrated that our ability to interpret climate change has been greatly aided by the encouragement and support given to multi-proxy/multi-disciplinary research. If there is one lesson which Palaeoclimate '93 taught us, it is surely that survival need not always be a struggle of the 'fittest', but rather a process of collaboration. In the present climate of change we can surely take some comfort in this philosophy.

Thanks and congratulations to **B.M. Funnell** and **M.J. Tooley** for organising this most enjoyable and stimulating meeting.

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**REPORT ON 'WINDBLOWN SEDIMENTS IN THE  
QUATERNARY RECORD'  
QRA/INQUA CONFERENCE, ROYAL HOLLOWAY,  
UNIVERSITY OF LONDON  
5th - 8th January 1994**

This was the first of the 'international' January QRA conferences, and it was a great success. It was a very concentrated conference and the evening sessions generated a little controversy - but they did work very well. More than 40 papers were presented, more than 20 posters were displayed and many conversations were held. I managed to attend all the lectures and examine all the posters and I will attempt an unbiased report, although subjective aspects must creep in. The balance was heavily towards loess; I estimate that perhaps 30 of the papers largely concerned loess. It is hard to pick out an obvious highlight but the discussions of the Tadjikistan loess were very impressive. There were 12 keynote lectures, four of which were held in the evening sessions. Abstracts from keynote lectures will be included in the next issue of the Newsletter.

The conference opened on Wednesday 5th; the guest of honour was to have been **Liu Tungsheng**, president of INQUA, but he was ill and **Horst Hagedorn**, a vice-president, did a great job of deputising. Liu's keynote lecture on the variability of the eastern Asian monsoon over the last climatic cycle was read by **Zhou Liping**. The first conference session was on particle origins, transport and bulk properties and comprised four keynote lectures by **I. Smalley**, **Ken Pye**, **A. Lazarenko** and **V. Osipov**. The second session, two keynote lectures on ancient and modern dust storms, was held on the Tuesday evening, after dinner. **Wang Jingtai** gave his lecture on the modern dust storms and loess deposits in China, and he showed an amazing video of a huge dust storm which had travelled from the NW down the Gansu corridor in May 1993. This left enormous deposits of material on the landscape, and the theme was neatly followed by **G. Kukla** in his talk on mysterious early glacial dust storms. He particularly discussed the 'marker' layers in the European loess, which can be caused by large dust storms such as the one described by Wang.

Thursday started with the aeolian sand session. **N.S. Embabi** made his contribution on the geomorphology and sedimentology of the aeolianites in the United Arab Emirates and this was followed by two Russian papers; **A. Drenova** on the reconstruction of palaeo-wind activity from dune sand characteristics and **S. Timirava** on comparative shape analysis of sand grains from loess and glacial series of the Russian plain. Then two papers from N of 68°N; **M. Seppala**, as clear and well organised as always, on the deflation and deposition of sand dunes in Finnish Lapland and a polished North American

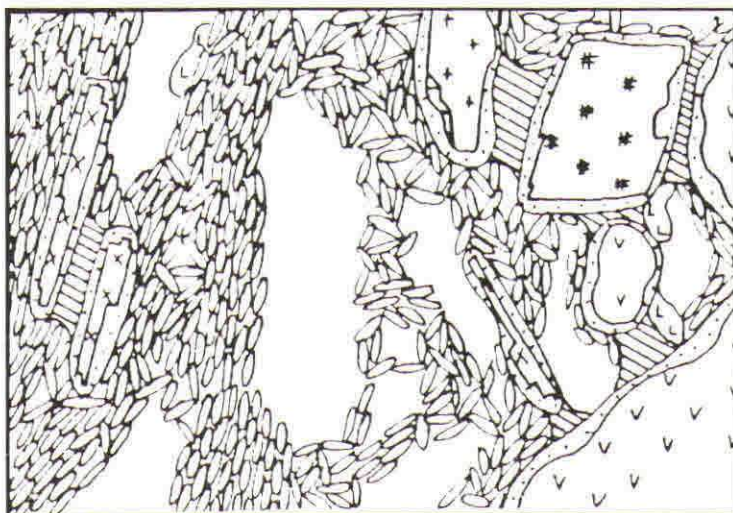


Figure 1. Hypothetical loess soil structure, by A. Klukanova.

discourse on the sand wedges and related aeolian sediments at Crumbling Point, Summer Island in the Pleistocene Mackenzie delta in Canada, by **J. Murton**. The second Thursday session carried us back to loess; **T. Dijkstra** on hydroconsolidation and subsidence of loess, which was largely a discussion of the collapse phenomenon at the single particle level. **A. Klukanova** continued with this theme and discussed loess sediment types in Slovakia; she is attempting the classic problem of relating structure to properties and produced some interesting hypothetical structures (see Figure 1). **A. Huijzer** talked on the palaeoenvironmental significance of cryogenic microfabrics in Weichselian loess deposits and loess-derived silt loams from the southern Netherlands.

The third session was on weathering, soils and palaeosols in aeolian sequences which opened with a keynote lecture by **J. Catt** on palaeosols in aeolian sequences as evidence of Quaternary environmental change. Then a study on weathering and pedogenesis of wind-blown sediments in Mount Carmel caves, Israel presented by **A. Tsatskin** followed by two Ukrainian contributions, both read by **J. Matviishina** - the first, written by **V. Perederiy** concerned weathering and material structure of the Pleistocene loesses of Ukraine and the second by **J. Matviishina** herself was on micromorphological characteristics as a reflection of Pleistocene pedogenesis. There were several excellent papers on micromorphology; they were one of the striking features of the conference. A short paper by **E. Yakimento** and then on to **R. Kemp's** presentation on pedosedimentary reconstruction of a thick loess-palaeosol sequence near



Lanzhou in north-central China. Next a very interesting paper by **J. Sayago** on loess stratigraphical and palaeopedological characteristics of the neotropical regions of Argentina and their relationship to Upper Pleistocene climates. This was a very welcome paper; there is a general feeling that the South American loess is deserving of more study, and that the right time may be approaching. **N. Fedoroff** gave his paper on aeolian sediments and their alteration in SE Spain, and the last paper before dinner was by **C. Ballantyne** on deposits of wind blown sand on the tops of Scottish mountains. This was a very impressive paper and suggested that aeolian material should be sought wherever we are.

After dinner two more keynote lectures of considerable quality: **N. Shackleton** on land-ocean correlation and **D. Krzyszkowski** on the Pleistocene stratigraphy of Central Europe and its relation to oceanic and loess records. Shackleton observed that it was possible to correlate ice volumes and loess accumulation - I wonder if there might be cause and effect relationship there? A cause and effect relationship was operating somewhere because Royal Holloway was suddenly engulfed in a Quaternary cold phase and we picked our way to the bar through snowdrifts. This was the evening when **J. Catt** had to abandon his car and complete his journey home on foot.

On Friday morning (still well in the cold phase) the stratigraphy of aeolian successions session continued with **A. Billard** on volcanic mineral assemblages from Mont-Dore in the Lower Pleistocene loessic silts at Saint Vallier, France, followed by **M. Frechen** on Middle and Upper Pleistocene deposits in volcanic craters from Central Europe. A bit of programme rejigging brought **A. Dodonov** on next to talk about loess stratigraphy of Central Asia. The presentations on Central Asia, largely about Tadjikistan, seemed to me one of the best features of the conference. These great Central Asian deposits offer stratigraphic riches for future years. Joint investigations (in particular Cambridge-Moscow-Dushanbe, with Royal Society support) are underway and some good results have been obtained. **Zhou Liping** presented some of the team's results relating to chronology and palaeoclimatic aspects of loess in Tadjikistan. **A. Bronger** (still in Tadjikistan) discussed loess-palaeosol sequences as witnesses of a palaeoclimatic record of the Quaternary in Central Asia, and showed some great micromorphology. Then **V. Ranov** showed us some impressive archaeology. There was little archaeology at the conference but Ranov showed some fine pictures of stone tools from the 'Loessic Palaeolithic' in South Tadjikistan (see Figure 2). **N. Gerasimenko** read two papers, on vegetation and climate changes during the loess accumulation period in Ukraine by **S. Turlo**, and microcycles of the Ukrainian loess series by herself, and then we all tramped through the snow to the Picture Gallery in the Founders Building for the launch of **D. Bridgland's** fine new book on 'Quaternary of the Thames'.





Figure 2. Stone tools from the 6th palaeosol in the loess of South Tadjikistan, by V. Ranov

The launch, and accompanying lunch, were by courtesy of the Joint Nature Conservation Committee (JNCC) of the United Kingdom.

In the afternoon the dating of silts and sand session opened with two keynote lectures; **J. Shaw** on magnetic dating of loess (plus great magnetic display via

OHP) and **A. Wintle** on luminescence dating of wind blown sediments. **A. Shinghvi** gave his paper on luminescence dating, aeolian accumulations and climatic epochs - a preliminary synthesis, and the last of the luminescence group was by **L. Zöller** on the correlation of the Last Glacial loess-palaeosol sequences throughout Middle Europe. The last three papers (with audience still all in place) were on amino-acid dating: **M. Bates** on the aminostratigraphic evidence for the timing of loess deposition in northern France; **E. Oches** on amino acid geochronology applied to Central European loess deposits, and **J. Mirecki** on aminostratigraphy of Late Pleistocene loess sequences with examples from the central Mississippi valley USA and southern Moravia in the Czech Republic.

Friday afternoon business was rounded off with a general discussion and it was interesting to note that the main topic was loess stratigraphy in Europe, those old problems of correlation that bothered **Julius Fink** in 1969 and led to the setting up of the INQUA Loess Commission are still being talked about, with some passion and commitment. It was strange to hear about the words 'Paudorf' and 'Stillfried' still being used so vigorously, and it was impressive to see the new TL and amino acid and micromorphology results being sucked into this old discussion. The conference ended with a great dinner in the Picture Gallery. Plenty of time for sherry beforehand, and to wander around and admire **Jim Rose's** favourite picture (The Railway Station - W.P. Frith) and enjoy the fantastic ambience, and a convivial dinner to follow.

Some final remarks: this was a truly international conference; delegates from 18 countries and this was largely due to vigorous activity by that inspired organiser **E. Derbyshire**, and support from the International Science Foundation, the Royal Society, the British Council, John Wiley, Chapman & Hall, the JNCC and INQUA. Royal Holloway offered excellent facilities, even two bars, one raucous and one hushed. The INQUA Loess Commission held a brief executive meeting and decided to propose the 'Rudolf Frahm Symposium: Löss in Europa' for the Berlin 1995 INQUA meeting. Some general impressions: the Chinese loess continues to dominate the world loess scene, the Central Asian loess looks more and more promising, the dating techniques (*eg* TL, IRSL, aminoacid) offer more and more precision, structural studies promise well - and we need to record our history. **L. Zöller** showed a picture of **K.C. von Leonhard**, the 'inventor' of loess at Haarlass near Heidelberg. We propose to celebrate the history and future of loess at Haarlass in 1998 (175th anniversary of K.C. v L's initiative) so start writing now.

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# REVIEWS

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## QUATERNARY OF SCOTLAND

Edited by J.E. Gordon and D.G. Sutherland  
Geological Conservation Review Series No. 6.  
Chapman and Hall, London.

ISBN 0-412-48840-X July 1993. 695pp. Hardback £96.00

This, the sixth volume in the Geological Conservation Review Series produced by the Joint Nature Conservation Committee, is concerned with the Quaternary heritage of Scotland, and brings together accounts of 138 GCR sites deemed worthy of conservation on account of their scientific, educative or historical interest. The work of 30 contributors, it is a marvellous *tour de force* of the Scottish Quaternary, and a testament to the great diversity of the landscape and the impressive range of work that has been conducted over the years. Divided into 18 regional sections, the book ranges from the interglacial deposits at Fugla Ness in Shetland to the coleopteran sites of the Borders, the rich periglacial mantle of An Teallach to deep-weathered granites in the North-east, encompassing a whole host of raised beaches, pollen sites and moraines in between, like a giant coffee-table QRA Guide. Few would argue with the choice of sites, and the coverage of both areas and themes is varied and representative. Certainly, all of my own 'Desert Island Scottish Quaternary sites' are featured, with the exception of the Old Man of Hoy and the beautiful Strath Dionard in Sutherland.

The book is much more than a catalogue of sites, however, as cohesion and continuity are provided by two introductory chapters and comprehensive introductions to each of the regional sections. The first chapter describes the rationale behind the choice of sites, then briefly outlines the main characteristics of the Quaternary period. This terse review covers the factors underlying Quaternary climatic change, goes on to summarise the use of oxygen isotope stages to subdivide Quaternary time, then sketches the nature of changing Quaternary environments. Due to constraints on space, this section is all too short, although sufficient references are provided to allow the interested non-specialist to follow up specific points.

Chapter 2, 'The Quaternary in Scotland', provides a clear and informative overview of environmental change in Scotland, and acts as a context for what follows. This chapter begins with a review of pre-Late Devensian events,

including a very stimulating account of the evidence for pre-Quaternary landscape evolution. Almost half of the chapter (14 pages) is devoted to these events, and it amply redresses any impression that Scotland contains little or no Quaternary record pre-dating the Late Devensian. The account of Late Devensian and Holocene environments is an even-handed and generally very up to date chronological survey covering glaciation, periglaciation, vegetational development and sea-level change. Throughout, reference is made to the pertinent GCRs described in the main part of the book.

The structure established in the introductory chapters is reinforced throughout the book. Each regional section is prefaced by a summary account of the area, introducing the GCR sites and providing a backdrop for the detailed descriptions and interpretations which follow. These regional introductions make fascinating reading in themselves, as they provide excellent reviews of the Quaternary history of each area, highlighting points of interest and identifying the main themes of research. All are written by the editors, who demonstrate an impressive knowledge of the landscape and grasp of the literature.

The main body of the text, of course, consists of accounts of the GCR sites themselves. Most accounts are concerned with single localities, such as a sediment exposure or landform, and follow a consistent format. Each begins with a brief introduction to the points of interest in the site, goes on to provide a detailed description of the evidence, and concludes with an interpretive section and a summary statement. On the whole, the accounts are concise and thorough, and the individual authors have done a fine job in summarising their own work or paraphrasing that of others. Where the interpretation of a site is controversial, most authors have presented well balanced summaries of alternative views, a particularly good example being John Gordon's excellent chapter on the shelly clay at Clava, a deposit variably interpreted as *in situ* marine sediment or a large glaciectonically-transported raft. Other chapters are rather more partisan, and present a single interpretation without critical comment. Examples include the chapter on the hummocky moraine in Coire a' Cheud Cnoic in Glen Torridon, which ignores the recent reinterpretation of the site by Matthew Bennett (although his work is cited in a different context), and that on the Gribun pollen site on Mull, which presents as fact a single (and almost certainly erroneous) interpretation of the geomorphological setting. These minor complaints notwithstanding, the site descriptions remain informative and well researched, and I very much enjoyed reading the accounts of the sites I know well, while discovering many places of which I knew little or nothing.

A few chapters are very broad in scope and deal with entire hill ranges or valley systems, rather than isolated sites. Areas chosen for this treatment include the Cairngorms, the Cuillin of Skye, the Western Hills of Rum and that showpiece of Scottish geomorphology, the Glen Roy area. These chapters provide highly readable surveys of classic landscapes, with a skillful blend of panorama and detail. Some are more up to date than others, recent views on moraine genesis, for example, being better represented in the Cairngorm chapter than that on the Cuillin.

The book is well produced and adequately illustrated with specially-drawn line diagrams and photographs. Most of the photographs are clearly reproduced and some are superb, such as the aerial views of the Baosbheinn protalus rampart and moraine on p. 117 and the Beinn Alligin slope failure on p. 121.

In all, *Quaternary of Scotland* is an invaluable sourcebook for those with an interest in the Scottish landscape, whether that interest is academic or motivated by a desire to protect sites from insensitive or inappropriate development. Unfortunately, the price will place the book beyond the pocket of most individuals, particularly impoverished Quaternary scientists with a straining book budget. *Quaternary of Scotland* is, however, an essential volume for the library of any institution with an interest in the Scottish landscape or the Quaternary in general, and if your department does not already have one, order it at once.

Doug Benn  
Department of Geography  
University of Aberdeen

# QUATERNARY OF SOUTH AMERICA AND ANTARCTIC PENINSULA VOLUME 8

Edited by J. Rabassa and M. Salemme  
Published by A.A. Balkema, Rotterdam, 1993  
ISBN 90-5410-140-7 ISSN 0168-6305 Price £44.00

This publication is a journal, produced at the rate of one 'issue' per year, in hardcover, and with the superficial appearance of a book. There is, unfortunately, no statement of editorial policy on subject matter (other than the title), nor on submission or reviewing procedures. Half of the sixteen editorial board members and both editors are from Argentina, with other board members from North America, Europe, and Venezuela. This particular volume contains thirteen papers, of which 5 are selected from an 'International Symposium of Quaternary Climates of South America', held in Medellin, Colombia, in 1990. Each paper is written in English, with abstracts in English and either Spanish or Portuguese.

The papers cover a broad range of subjects and geographical areas within South America, written largely by South Americans. The topics are varied and broad in terms of discipline and geographical location; late Quaternary pollen work from Chile (by Villagrán) and Brazil (by Roth and Lorscheitter), a geomagnetic reversal from Argentina (by Sinoto and Orgeira), a new species of mammal from Argentina (by Esteban), Quaternary stratigraphy of northwest Argentina (By Zárate, Camilión, and Iasi), present ecological range of algae, Testacea, and fungal remains found in Colombian moss samples (by Grabandt), reviews of the Quaternary of southern Uruguay (by Navarro) and Peruvian palaeoclimates (by Macharé, Veliz, Ortleib, and Dumont), a detailed description of modern glaciers of the Sierra Nevada de Santa Marta, Colombian (by Rabassa, de Lasa, and Siciliano), Quaternary stone lines in Colombia (by Arboux), Colombian lahars and mudflows (by James, Giraldo, and Schurink), sedimentary evidence for climate changes in western Amazonia (by Kronberg and Benchimol), and tephrastatigraphy from Colombia (by Toro and Hermelin). All are reasonably presented and illustrated, although the small size of the page (22.5 x 14.5cm) does not lend itself well to the production of figures or tables.

The scientific quality of the papers is good, and there is much of interest here. The current market of Quaternary scientific literature is dominated by publications from, and about, European and North American matters. Work in these areas constitutes most of what is usually considered 'international

literature'. Research on other continents has a much lower level of penetration into this literature, and this is reflected by the existence of 'regional' journals such as *The Quaternary of South America and Antarctic Peninsula*. Any one working in South America should see it, but others might well find that it contains as much useful and relevant material as more familiar journals.

**K.D. Bennett,**  
**Department of Plant Sciences**  
**University of Cambridge**

# ABSTRACTS

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## THE DEVENSIAN LATEGLACIAL AND EARLY FLANDRIAN STRATIGRAPHY OF SOUTHERN SNOWDONIA, NORTH WALES

Stephen Lowe (Doctor of Philosophy)  
Department of Geography, QMW,  
and Department of Geography, London Guildhall University

### ABSTRACT

This thesis examines various aspects of the Devensian Lateglacial and early Flandrian stratigraphy (c. 14-19Ka radiocarbon years BP) of southern Snowdonia, North Wales. Pollen analyses and radiocarbon dating of lake sediments are combined with geomorphological mapping of former glacier and snowpatch limits to reconstruct the effect and timing of environmental change on the Lateglacial and early Flandrian vegetation and landscape.

The geomorphological field evidence for the extent and distribution of former "cwm" glaciers and snowpatch limits is described and illustrated by a series of detailed maps. This mapping provides the basis for palaeo-glacier reconstructions which, in turn, are used to derive some climatic inferences for the time when the glaciers achieved their maximum extent. Pollen analyses of sedimentary successions from both inside and outside these former ice limits are used to try and establish a relative age for the glaciation. The pollen stratigraphical evidence suggests a Loch Lomond (Younger Dryas) Stadial age (c. 11-10Ka radiocarbon years BP) for the cwm glaciation. During the course of these investigations an innovative method of sampling upland lake pollen sites by sub-aqua divers was developed and is fully documented.

Pollen analyses are also used to provide information on the Lateglacial and early Flandrian vegetational history and associated environmental changes for the area. A radiocarbon chronology, derived from an exceptionally thick sequence of Lateglacial and early Flandrian organic-rich sediments is presented and provides a particularly high degree of stratigraphic resolution for dating changes in the pollen and sedimentary record. The stratigraphical information obtained from these different lines of enquiry is combined and synthesised to identify some key aspects of Lateglacial and early Flandrian environmental change.



# THE ORIGIN AND SEDIMENTOLOGY OF THE LOWER PLEISTOCENE WESTLETON BEDS, EAST ANGLIA, U.K.

John M. Sinclair (Master of Philosophy)

Department of Geography, London Guildhall University

## ABSTRACT

Sedimentological and clast lithological analyses of the Lower Pleistocene "Westleton Beds" of East Anglia are presented. These analyses indicate that the deposit is extremely lithologically distinctive and that it comprises four major sedimentary facies which are particularly well exposed in the Southwold area of the Suffolk coast. The four facies which have been recorded are: beachface gravels, upper shoreface sandy megaripples, upper shoreface gravel-lined rip channel scours and lower shoreface gravel pavements. The relationships between these facies and also their relationship to a fifth, underlying tidal sand flat facies indicates that the majority of the deposit developed on a macrotidal shoreline which was experiencing marked marine transgression and which was dominated by wave processes. Post-depositional tilting has affected these sediments such that the southern and western-most limits of the deposit appear to have been up-warped by approximately  $1 \text{ m.km}^{-1}$ , relative to the Suffolk coast.

Clast lithological analysis of gravels from the various facies confirms Hey's (1967, 1976, 1982) claim that the deposit is dominated by flint, much of which is rounded and chattermarked. Within the flint component, a new subdivision has been recognised: Sinclair (1990) reported the discovery of spicular flint, attributed to sources in Lincolnshire and (formerly) in Yorkshire. This, combined with the presence of *Rhaxella* chert from the Yorkshire Corallian suggests that significant quantities of the gravel are derived from the north, probably by longshore drift. However, additional components include small quantities of vein quartz and quartzites thought to be derived from the Midlands, as well as cherts from the Lower Greensand and the Carboniferous. These components are thought to be evidence of an input from an early Thames, perhaps with an additional input from the Midlands. This suggests that the Kesgrave Sands and Gravels may be older than has previously been recognised.

Following recent revisions of stratigraphic nomenclature within the British Pleistocene and the accepted stratigraphic codes, it is proposed that the misleading term "Beds" be dropped from the name of the deposit and that it should become the Westleton Sand and Gravel Member of the Norwich Crag Formation.

The Westleton Sand and Gravel lacks any significant fossil remains and so cannot be definitely assigned to any of the existing Lower Pleistocene chronostratigraphic stages. However, it is demonstrably wholly post-Bramertonian and is post-Baventian, at least in part. It is suggested that the Westleton Sand and Gravel formed during an as yet unnamed temperate stage of the British Lower Pleistocene between the Baventian and the pre-Pastonian a. This suggests a Middle Tiglian age, by comparison with the Dutch Quaternary sequence.

The distinctiveness of the deposit and its limited temporal extent mean that it has the capability to act as an important stratigraphic marker in the Lower Pleistocene sequence of East Anglia, particularly in areas such as southern Norfolk where the equally distinctive Baventian/Chillesford Clay is absent.

# NOTICES

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## 1. PROPOSALS FOR FUTURE QRA MEETINGS

All members of the QRA are invited to make suggestions concerning the venues and topics of future field and discussion meetings. At present, the QRA sponsors two main types of meeting.

1. *Discussion Meetings*, centred around a particular theme. The Annual Discussion Meeting is usually held in January, but in recent years there has been a trend towards two or more discussion meetings per year, often in association with cognate organisations such as INQUA, IGCP and the Geological Society.

2. *Field Meetings*, usually held at weekends between April and September, though these may range from one day to one week in duration. The Annual Field Meeting and AGM is usually held in April or May. Field meetings have hitherto been devoted to examining various aspects of the Quaternary within particular areas, both in Great Britain and in other parts of Europe.

In addition to the traditional diet of field and discussion meetings, the Executive Committee of the QRA invites members to offer or make suggestions concerning two additional types of meeting:

1. *Thematic field meetings*. The purpose of such meetings will be to focus on a certain aspect of Quaternary Science rather than a particular area. Such meetings will supplement the traditional programme of 'area-based' field meetings. Examples of the kinds of topics that might be dealt with in a thematic field meeting are 'Cave deposits and their interpretation', 'The Anglian Glaciation in England' and 'Pingo scars in Wales and East Anglia'. The short field meeting being held in the NW Highlands on 6-8 May 1994 will form a prototype for this kind of meeting, being devoted to processes and landforms of glacial, glaciolacustrine and glaciofluvial sedimentation rather than the wider aspect of the Quaternary of this area. It is anticipated that such meetings will attract a gathering of specialists on the topic in question as well as members interested in expanding their experience, and thus provide a fruitful vehicle for informed debate and the generation and dissemination of new ideas. By their nature, such thematic meetings may require to be based on more than one centre.

2. *Meetings with a training element.* The purpose of such meetings will be to allow members to gain experience in particular methods or analytical techniques. Such meetings would be led by experts in the field and would be of particular value to postgraduate students as well as QRA members who wish to add to the range of techniques at their disposal, or to see how colleagues approach their field of research. Examples of the kinds of topic envisaged are 'Coring and sampling methods in palynology', 'Geophysical techniques in Quaternary Research' and 'Field and laboratory analysis of palaeosols'. Such meetings may be field or laboratory based, or involve some combination of the two. It is envisaged that a limit will be placed on the number of participants to allow effective training in the techniques being demonstrated.

A full programme of three discussion meetings and four field meetings has already been finalised for 1994, and the programme for 1995 is currently being organised. Members who wish to suggest or offer discussion, field, thematic or training meetings during the period 1995-7 are invited to contact the Convenor of the Meetings Subcommittee: Dr Colin Ballantyne, Department of Geography, University of St Andrews, St Andrews KY16 9ST (telephone 0334-63909 or 73481; Fax 0334-63949).

## **2. YOUNG RESEARCH WORKERS AWARDS**

The Quaternary Research Association has a small fund to assist young research workers with fieldwork expenses and to defray costs in giving papers at conferences. Grants (not normally exceeding £150) will be made to postgraduate students currently registered for a higher degree and who are members of the Quaternary Research Association of at least one full year's standing. As funds are very limited preference is given to those who have no source of fieldwork or conference funding or whose access to such funds is limited. Priority will be given firstly to applications for assistance with fieldwork costs and secondly to applications for conference support.

Application forms may be obtained from the convener of the QRA Young Research Workers Awards Committee (see below) and should be returned by the 31st December 1994. Recommendations for awards will be considered by the Executive Committee of the QRA at their January 1995 meeting. Retrospective applications will not normally be considered so all applications should relate to fieldwork or conferences planned for 1995. Applicants should set out clearly the purpose for which the award is intended, together with a full

breakdown of the costs involved and a statement of other sources of funding to which the applicant may have access.

Successful applicants will be informed within a month of the January 1995 meeting of the QRA Executive and will receive their grants from the Treasurer of the Association shortly thereafter. It is a condition of any award that the applicant submit a brief (c 200 word) report on the project for which a fieldwork award was made or the abstract of any conference paper supported to the convener of the awards committee. Reports will be edited and published in the Quaternary Newsletter. Receipt of any award should also be acknowledged in any publication derived from the work supported.

Dr M.B. Seddon  
Department of Zoology  
National Museum of Wales  
Cathays Park  
Cardiff CF1 3NI

### **3. ANNOUNCEMENT OF OPPORTUNITY: NERC RESEARCH OPPORTUNITIES IN THE ARCTIC**

In furtherance of its strategy for promoting Arctic environmental research, the Natural Environment Research Council has leased laboratory space at Ny-Alesund on Spitsbergen in the Svalbard Archipelago.

Ny-Alesund (7°N 11°E) is the world's most northerly permanent settlement and is the former site of a coal mining activity. The coal company, the King's Bay Kull Company A/S (KBKC) still runs and operates the settlement and provides scientific and living accommodation. Ny-Alesund is the site of the Norsk Polarinstitut base and there are also research facilities of other nations including France, Germany and Japan on site.

Facilities made available by the Natural Environment Research Council consist of 120 sq.m. of laboratory space which is equipped, as a general laboratory with an emphasis towards terrestrial ecology. The laboratory (Harland Huset) is sited in a specially built facility. Accommodation and messing is available from the KBKC at a cost of NOK500 per day (estimated 1994 prices, could be subject to change), for full board and accommodation, for periods of one week or longer. A rate of NOK400 for accommodation at Harland Huset may be available.

Opportunities now exist for researchers in universities, research institutes and other organisations to carry out a variety of environmental research at Ny-Alesund. This location is particularly suitable for ecological research, glacial and periglacial geomorphology, hydrology and atmospheric chemistry.

Researchers wishing to use the Natural Environment Research Council laboratories on Ny-Alesund will be responsible for their own travel and accommodation costs and for complying with local regulations for conduct at Ny-Alesund; fieldwork guidelines issued by the Norsk Polarinstitutt; and the NERC code of conduct for operations in Svalbard including requirements for firearms and field safety training. UK Researchers are also required to submit abstracts of their research proposals to the Norsk Polarinstitutt.

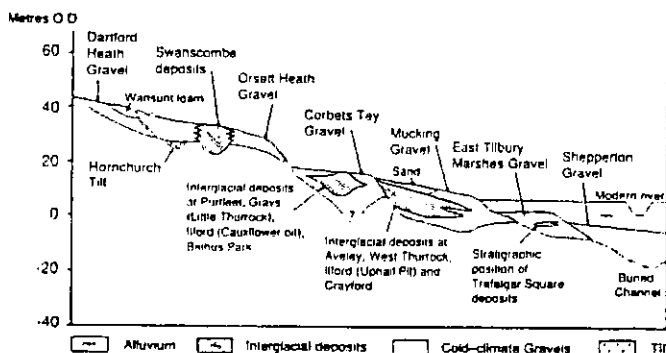
Applications, by letter, should state the full scientific case for the research and the detailed programme proposed for Ny-Alesund. Applicants should also indicate any agreed collaborative arrangements, especially those with Norwegian colleagues. Information is also required on the number of personnel involved, specialised equipment use, storage requirements, sources of finance for travel to and from Ny-Alesund and for accommodation, and the length of stay at the settlement.

Applications for use of the facilities in the 1994 field season should be sent to Dr Andy Stainthorpe, Polar Sciences Section, NERC, Polaris House, North Star Avenue, Swindon SN2 1EU (Tel: 0793 411651, Fax: 0793 411691) by 28 February 1994. For additional information about facilities available in Harland Hütset contact Mr Nick Cox, NERC Institute of Terrestrial Ecology, Merlewood Research Station, Grange-over-Sands, Cumbria LA4 6JU (Tel: 05395 32264, Fax: 05395 34705).

**4. MIDLANDS QUATERNARY LECTURE**  
**Coventry University, Centre for Quaternary Research**

**Dr. D. Bridgland**  
**University of Durham**

**Thames Terraces : Britains' Best long  
terrestrial sequence**



**February 23rd 5.00pm**  
**N122**

All staff and students are most welcome.  
For further details contact Alastair Dawson.  
(0203-838556) or David Keen (0203-838692)

**5. NATO ADVANCED RESEARCH WORKSHOP: 'GENESIS  
AND PROPERTIES OF COLLAPSIBLE SOILS'**

**11th-14th April 1994**  
**Loughborough University**

**KEYNOTE SPEAKERS INCLUDE**

J.H. Atkinson (London, UK), J. Feda (Prague, Czech Republic), G. Kukla (New York, USA), G. Lefebvre (Sherbrooke, Canada), Lin Zaiguan (Xian, China), I.J. Smalley (Loughborough, UK), J.K. Torrance (Ottawa, Canada), and K.J. Tovey (Norwich, UK)

**with invited speakers including:**

R. Handy (Iowa, USA), R. Yong (Montreal, Canada), H. Muecher (Amsterdam, The Netherlands), S.P. Bentley (Cardiff, UK), D.G. Fredlund (Saskatoon, Canada), Z. Jary (Wroclaw, Poland), S.L. Houston (Tempe, USA), Y. Reznik (Pennsylvania, USA), D. Evstatiev (Sofia, Bulgaria), V.I. Osipov (Moscow, Russia), A. Klukanova (Bratislava, Slovakia), A.J. Lutenegger (Amherst, USA), T. Muxart (Meudon, France), J. Locat (Quebec, Canada), Theocharopoulos (Athens, Greece).

**Convener**

**Professor Edward Derbyshire**

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Egham, Surrey TW20 0EX, UK

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**Local Secretary**

**Dr. Tom A. Dijkstra**

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Loughborough University of Technology

Loughborough LE11 3TU, UK

Fax: +44-509-610231

## **6. GIBRALTAR QUATERNARY CONFERENCE**

**1-3 July 1994**

**Second Draft Programme**

**1 July - Session 1**

**Chair:**           Joaquin Rodriguez, Geology Department, University of Seville  
Clive Finlayson, The Gibraltar Museum

### **Historical and physical aspects of the Quaternary in Gibraltar**

0930-1000   History of the Gibraltar Excavations  
Clive Finlayson, The Gibraltar Museum

105-1035    The Pre-Quaternary geological evolution of Gibraltar  
E.P.F. Rose & M.S. Rosenbaum, University of London

1040-1100   Coffee

1100-1130   Geomorfologia: analisis del relieve  
J. Rodriguez-Vidal, University of Sevilla



- 1135-1205 Variaciones del nivel del mar: Atlantico-Mediterraneo  
C. Zazo, CSIC Madrid
- 1210-1240 Quaternary Geology of Gibraltar: aspects of erosion and deposition  
E.P.F. Rose & E.C. Hardman, University of London
- 1245-1315 Sedimentologia karstica  
M. Hoyos, CSIC Madrid

# 1 July - Session 2

**Chair:** Chris Stringer, Natural History Museum, London

## Palaeolithic and Neolithic Gibraltar

- 1530-1630 The Neanderthals  
C. Stringer, Natural History Museum, London
- 1635-1700 Tea
- 1700-1730 The Neanderthals in Zafarraya  
C. Barroso, Malaga & J.J. Hublin, Paris
- 1735-1805 Estado actual de las investigaciones sobre el poblamiento paleolitico en Gibraltar y nuevas aportaciones a la secuencia del paleolitico superior.  
F. Giles Pacheco, Vocal de prehistoria de QEQUA y Director del Museo del Puerto de Santa Maria  
A. Santiago Perez, Secretario de AEQUA-GAC  
J.M. Gutierrez Lopez, AEQUA-GAC  
E. Mata Almonte, AEQUA-GAC
- 1810-1840 Pleistocene faunas of Gibraltar  
A. Currant, Natural History Museum London
- 1845-1915 La ocupacion humana desde el neolitico al bronce en cavidades ineditas del Penon de Gibraltar  
J.M. Gutierrez Lopez, AEQUA-GAC  
A. Santiago Perez, Secretario de AEQUA-GAC  
A. Mata Almonte, AEQUA-GAC  
F. Giles Pacheco, Director del Museo del Puerto Santa Maria  
Ma del Carmen Prieto Coria, AEQUA-GAC  
B. Gonzalez Toraya, AEQUA-GAC  
Isabel Caceres, AEQUA-GAC  
L. Aguilera Rodriguez, AEQUA-GAC

## **2 July - Session 3**

**Chair:** Maria Belen Deamos, University of Sevilla

### **Historical Archaeology**

- 0930-1000 Gibraltar como encrucijada. Consideraciones sobre la prehistoria del Estrecho  
**Jose Luis Escacena, Universidad de Sevilla**
- 1005-1035 Santuarios fenicios de occidente  
**Maria Cruz Marin, Universidad de Sevilla**
- 1040-1100 Coffee
- 1105-1135 Santuarios costeros de Andalucia  
**Inmaculada Perez, Universidad de Cadiz**
- 1140-1210 Gorham's Cave, un santuario marino en el Estrecho  
**Maria Belen, Universidad de Sevilla**  
**Inmaculada Perez, Universidad de Cadiz**
- 1215-1245 Phoenician and Roman marine archaeology in the Gibraltar and the Strait  
**Mensun Bound & Tim Dingemans, Oxford University**  
**M. Bowyer, University College of Wales, Bangor**
- 1245-1315 Evolucion de la estrategia territorial del estrecho de Gibraltar durante la antigüedad  
**Jose Castineira Sanchez, Director del complejo arqueológico de Baelo Claudia. Miembro de AEQUA-GAC**  
**Juan Campos Carrasco, Profesor titular de Arqueología, Universidad de Huelva. Miembro de AEQUA-GAC**

## **2nd July - Session 4**

**Chair:** Chris Stringer

### **Summary, Discussion and Conclusions**

- 1530-1630 Present-day environments and their relationship to those of the Pleistocene.  
Discussion led by: **Cari Zazo, Ted Rose, Joaquin Rodriguez-Vidal, Clive Finlayson, Andy Currant**
- 1630-1700 Tea

- 1700-1800    The Neanderthal-modern human transition in southern Iberia  
 Discussion led by: **Chris Stringer, J.J. Hublin, Cecilio Barroso, F. Giles Pacheco**
- 1800-1900    The Gorham's shrine in the context of maritime activity in the area of the Strait  
 Discussion led by: **Maria Belen, Inmaculada Perez**
- 1900-1930    Conclusions

The third day will be devoted to site visits.

Further information is available from:

Dr Clive Finlayson  
 The Gibraltar Museum  
 18-20 Bomb House Lane  
 Gibraltar  
 Tel: 74289  
 Fax: 79158

## **7.    15th INTERNATIONAL RADIOCARBON CONFERENCE: GLASGOW, SCOTLAND**

The 15th International Radiocarbon Conference will be held in Glasgow in the Royal Scottish Academy of Music and Drama (RSAMD) during 15-19 August 1994. A number of specialist Workshops will be held during the preceding weekend, *ie* 13 and 14 August.

**The broad themes of the Conference are:**

- $^{14}\text{C}$  in the Reconstruction of Past Environments
- $^{14}\text{C}$  As a Tracer of the Dynamic Carbon Cycle in Current Environments
- Accelerator Techniques
- Calibration of the  $^{14}\text{C}$  Timescale
- $^{14}\text{C}$  in Archaeology
- Advances in Beta Counting

### **Pre-Conference Workshops**

Whole day sessions will be given to discussion of each of the following topics:

PAGES (Past Global Change) Chronologies  
Carbon in the Oceans  
AMS Sample Preparation  
Tephra Studies and Radiocarbon Dating  
 $^{14}\text{C}$  in Soils  
Archaeology  
TIRI (Third International Radiocarbon Intercomparison)  
Liquid Scintillation Counting

For detailed information on the Conference and/or Workshops, please contact:

Douglas Harkness

NERC Radiocarbon Laboratory, EAST KILBRIDE G75 0QU, Scotland.

Telephone: 03552 60037 Fax: 03552 29829

Requests to be placed on the mailing list for circulars and registration forms for the Conference and/or Workshops should be made to the Conference Secretariat,

Mrs M Smith, Department of Statistics,

University of Glasgow, GLASGOW G12 8QW, Scotland

Telephone: 041 339 8855 Ext. 5024 Fax: 041 330 4814

### **8. INTERNATIONAL WORKSHOP ON PALAEOENVIRONMENTAL RECORD OF DESERT MARGINS AND PALAEMONSOON VARIATION DURING THE LAST 20 KA**

**XIAN, CHINA**

**August 16-25, 1994**

**Sponsored by: IGCP-349 and INQUA Loess Commission**

**Organising Committee:**

**Prof. An Zhisheng (China)**

**Prof. E. Derbyshire (UK)**

**Prof. A.K. Singhvi (India)**

Additional members would be co-opted by the above committee.

**Objective:**

The Workshop will mainly explore the movement of desert margins during the last 20Ka, 9Ka and present. The field excursion will comprise visits to the wind-blown sand-palacosol sequences, loess-palaeosol sequences, lake-marsh deposits, ancient great wall buried by sand and associated landforms. This workshop would be targeted for understanding the relation between the palaeoenvironmental changes and the palaeomonsoon variations in terms of palaeoclimatic dynamics of shifting loess-desert transitional zone.

**Programme:**

- I Field trip excursion and training course - August 16-23, 1994  
Route: Zhong Wei (Ning Xia province) - Sha Po Tou (Tengeri desert)  
- Jing Bian - Yu Lim (Mu Us desert) - Yan'an (loess plateau) - Xi'an
- II Workshop: Xi'sn, August 24-25, 1994

**Payments:**

- I Registration fees: US\$200
- II Accommodation and traffic fees: US\$60 per day for each person (estimated)

For further details and second circular, please register immediately with:

Prof. An Zhisheng  
Xi'an Lab. Loess & Quaternary Geology  
Academia Sinica  
Xiao Zhai East Rd. 3, Xi'an 710061  
Shaanxi (China)  
Fax: (86) 29-752566  
Phone: 29-55953 Ext. Prof. An Zhisheng

**9. IGCP DESERT MARGINS PROJECT 349**

**Project Title: "Desert Margins and palaeomonsoons of the Old World since 135,000years BP" (1993 to 1997)**

Project leaders:

<b>Professor E. Derbyshire</b>	(Royal Holloway & Bedford New College, London, UK)
<b>Professor An Zhisheng</b>	(Academia Sinica, Shaanxi, China)
<b>Professor A.K. Singhvi</b>	(Ahmedabad, India)

This project is focussed on the problems of climatic change associated with shifting desert margins through the last glacial period. Dry lands are sensitive indicators of past changes in climate and one of the aims is to improve our understanding of spatial and temporal changes in monsoon patterns and the impact on the desert margins. As with all IGCP projects, a further objective is to achieve discussion and information flow between all parties who have a research interest in the region, with the specific requirement to improve stratigraphic and palaeoclimatic correlations from the Sahara to the Middle Yellow River. Thus this project is concerned with collating and comparing data on shifting desert margins and hence expects to involve scientists with very diverse interests, especially those who are using various forms of absolute dating.

### **UK contributors**

At present we are gathering information about any existing projects or future proposals which provide climate-proxy data or absolute dating controls in the region. One of the future objectives is to attempt to build up maps showing key stages of climatic change.

Please write to the address below if you are willing to contribute to data collection or if you wish to be informed of continuing progress on the project.

### **UK Report 1994**

I will be collating a report describing UK activity relating to this project in August this year and welcome copies of any reprints describing activities which may have data which could be used in reconstructing patterns of palaeoenvironmental change.

### **International Workshop on the Palaeoenvironmental record of Desert Margins and Palaeomonsoon Variation during the last 20 Ka**

This meeting will form the second workshop of project 349 and is co-sponsored by the INQUA loess commission. The meeting will be held in Xian, China, from August 16 to 15 in 1994. Further details and a second circular can be obtained from Professor An Zhisheng, Xi'an Lab. Loess, Academia Sinica, Xi'an 710061, Shaanxi, China (Fax: 010-86-29-7525660).

### **UK Correspondent**

Dr Mary B. Seddon, Department of Zoology, National Museum of Wales, Cathays Park, Cardiff, UK CF1 3NP  
Telephone: 0222-397951 Ext. 244 Fax: 0222-239009

## **10. SEQS SYMPOSIUM**

**11th - 15th October 1994, Lodz**

**"The Cold Warta Stage - lithology, paleogeography, stratigraphy"**

**Organisers:**

**INQUA - SEQS**

Committee of Quaternary Research of the Polish Academy of Sciences

Chair of Quaternary Research of the University of Lodz

**Provisional programme:**

2 days: paper and poster sessions (Conference Centre, Lodz University)

3 days: field excursions (Central Poland, brown coal opencasts Belchatow and Turek, outcrops in the vicinity of Lodz)

**Provisional cost:**

approximately 250 US-Dollars

This includes the full board, accommodation (single and double rooms) at the Conference Centre of the University, transport during the field excursions and conference material.

Further details can be obtained from:

Mrs. Prof. Dr. Halina Klatkova

Katedra Badan Czwartorzedu

Universytetu Lodzkiego

ul. M., Skłodowskiej-Curie II

PL - 90-505 Lodz (POLAND)

Tel: Lodz 37 60 58

Fax: Lodz 33 92 59

## **11. FIRST NOTICE AND CALL FOR PAPERS**

**QRA ANNUAL DISCUSSION MEETING,  
EDINBURGH 5th-7th JANUARY, 1995**

**'THE LATEGLACIAL PALAEOCEANOGRAPHY  
OF THE NORTH ATLANTIC MARGINS'**

**A meeting sponsored by:**

**The Quaternary Research Association (QRA)**

**The Marine Studies Group of the Geological Society**

**The North Atlantic Seaboard Project (NASP) of IGCP-253,**

**'Termination of the Pleistocene'**

### **Venue:**

Discussion meeting (Thursday 5th and Friday 6th January, 1995)  
**The Royal Society of Edinburgh**

Workshops (Saturday 7th January, 1995)  
**The Grant Institute, University of Edinburgh**

### **Organising Committee:**

Professor J.T. Andrews (Boulder, USA)

Dr W.E.N. Austin (Edinburgh, UK)

Dr H.E. Bergsten (Göteborg, Sweden)

This two-day international meeting and workshop is intended to stimulate open discussion and address aspects of Lateglacial North Atlantic palaeoceanography as recorded around its margins. Particular emphasis will be placed upon the margins and the high temporal resolution which such locations provide. Some of the potentials and problems associated with high resolution palaeoceanographic studies at such sites, particularly the nature of their links with the terrestrial and deep-sea records, will be discussed. A series of thematic sessions are proposed and these will be introduced by one or two key-note speakers; invited key-note speakers who have already agreed to attend the meeting include:

<b>Scott Lehman</b>	(Woods Hole Oceanographic Institution, USA)
<b>John Andrews</b>	(University of Colorado, USA)
<b>Eystein Jansen</b>	(Geologisk Institutt, Bergen, Norway)
<b>Jean-Claude Duplessy</b>	(Centre des Faibles Radioactivités, Gif-sur-Yvette, France)
<b>Geoffrey Boulton</b>	(University of Edinburgh, UK)
<b>Hans-Petter Sejrup</b>	(Geologisk Institutt, Bergen, Norway)

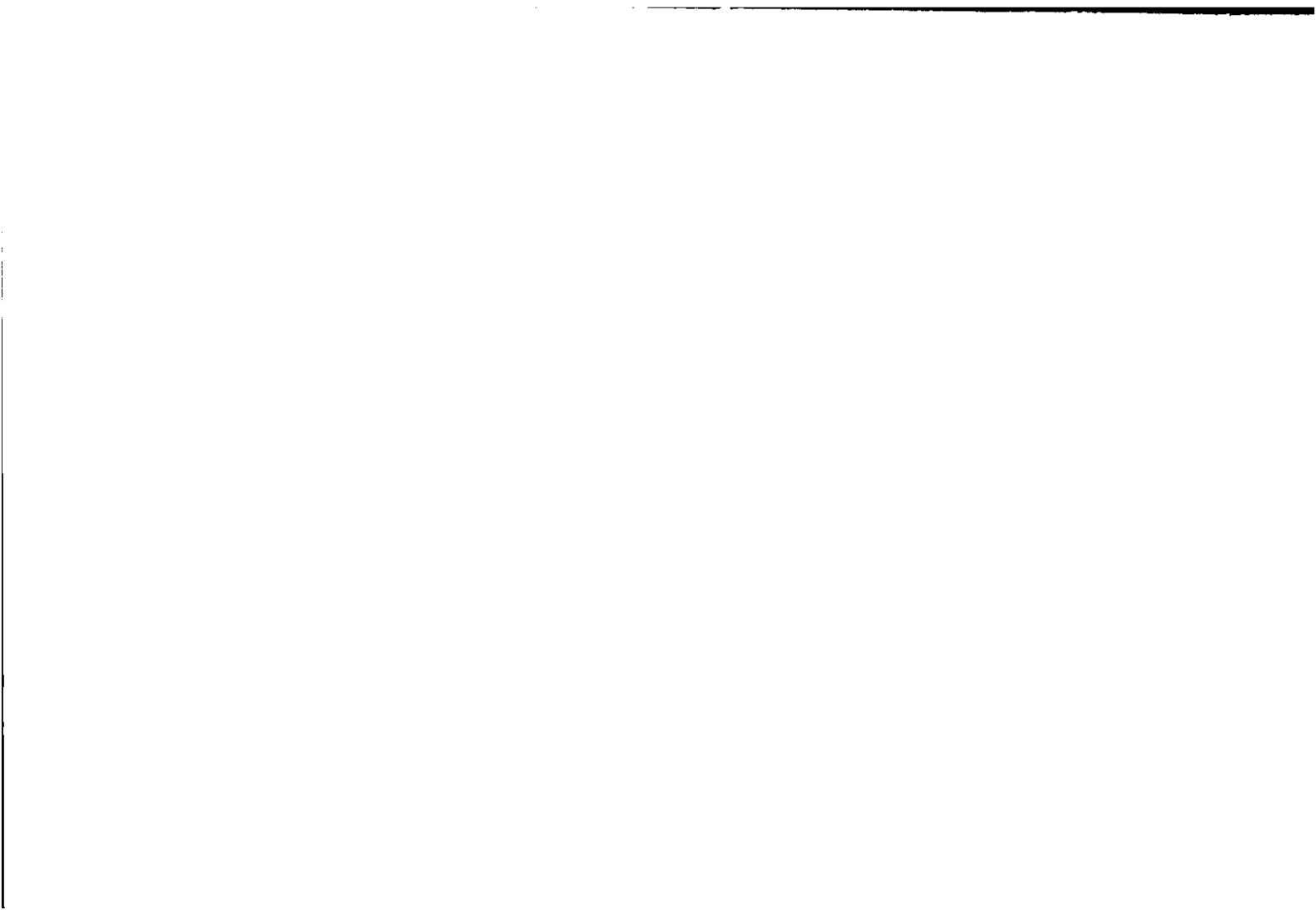
### **Call for Papers**

The organisers now invite contributions; please state whether you prefer to make an oral or poster presentation. These may address any relevant topic, although contributions which attempt to correlate terrestrial and marine records are particularly welcome. It is intended to publish a Symposium Volume. Potential authors are reminded and encouraged that manuscripts should be ready for review immediately following the conference.



Further details of the meeting and workshops, including full registration forms, will appear in the next edition of the Quaternary Newsletter. Meantime, further information is obtainable from and presentation contribution offers should be addressed to:

Dr. William E.N. Austin,  
Department of Geology and Geophysics  
Grant Institute, West Mains Road  
Edinburgh, EH9 3JW  
Scotland, UK  
Tel: 031-650 5943  
Fax: 031-668 3184  
e-mail: <WENA@GLG.ED.AC.UK>



## 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 and Australasia. Membership (currently c. 1100) is open to all interested in the objectives of the Association. The annual subscription is £10 with reduced rates for students and unwaged members.

The main meetings of the Association are the Annual Field Meeting, usually lasting 3 or 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, with four issues a year; the monograph series *Quaternary Proceedings*; the Field Guides 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. The current officers of the Association are:

**President:** *Professor G.S. Boulton FRS*: Grant Institute of Geology, University of Edinburgh, West Mains Road, Edinburgh EH9 3JW

**Vice-President:** *Professor J.J. Lowe*, Department of Geography, Royal Holloway, University of London, Egham, Surrey TW20 0EX

**Secretary:** *Dr. M.J.C. Walker*: Department of Geography, University of Wales, Lampeter, Dyfed SA48 7ED, Wales

**Assistant Secretary (Publications):**

*Dr. W.A. Mitchell*, Faculty of Sciences, Luton College of Higher Education, Park Square, Luton LU1 3JU

**Treasurer:** *Dr. J.E. Gordon*: Scottish Natural Heritage, 2, Anderson Place, Edinburgh EH6 5NP

**Editor, Quaternary Newsletter:**

*Dr. J.D. Scourse*: School of Ocean Sciences, University College of North Wales, Menai Bridge, Gwynedd LL59 5EY

**Editor, Journal of Quaternary Science:**

*Dr. P.L. Gibbard*: Subdepartment of Quaternary Research, Botany School, Downing Street, Cambridge CB2 2TF

**Publicity Officer:** *Mrs H. Davies*: Pharm House, Neston Road, Willaston, South Wirral, Merseyside L64 2TF.

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



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