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# QUATERNARY NEWSLETTER

Editor: Dr B J Taylor  
British Geological Survey  
Keyworth  
Nottingham NG12 5GG

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# EDITORIAL

Dear colleagues

**Again and again!**

My last editorial elicited some comments on.....

Brian Taylor  
Editor

P.S. I hope that the above will satisfy those who have expressed the view, though not directly to me, of 'excessive editorial comment inappropriate with the context of the Newsletter'.



## SHILLOW — A NEGLECTED HOLOCENE REGOLITH ON LIMESTONE

R Frank

Department of Geography, Newcastle University

### Abstract

The long and intermediate axes of loose rock fragments (shillow) on limestone dip slopes are a result of bedrock joint geometry. The short axes are bedding planes and increase with increase in the number of beds exposed along the slope. Downslope, these three axial dimensions and weight of the shillow first decreases toward the middle of the slope, then increases toward the bottom. This is a result of the larger fragments moving down the slope at a faster rate than the smaller fragments combined with a decrease in shillow size while they are in transport.

### Introduction

Shillow, loose rock fragments on limestone bedrock dip slopes, is a common material in karst areas and has often been mentioned in the karst literature (Corbel, 1957; Sweeting, 1966, 1972, 1974; Jennings, 1972, 1985; Ford and Williams, 1989). These authors, and others, consider shillow to be a natural consequence of the post-glacial weathering of the clints of limestone pavements, especially when the limestone is thin-bedded. Despite the recognition of shillow as a specific type of weathering product, no substantive investigations have been made of it, except for the limited preliminary work of Frank (1977).

Frank (1977) used the term 'clitter' to describe this material following Tinkler (1966) who distinguished it from thicker deposits of scree. However, 'clitter' has been more recently defined by Monkhouse and Small (1978), Whittow (1984) and Goudie (1985) as consisting of granite boulders. Consequently, the Northern England colloquialism 'shillow' — used specifically for limestone rock fragments — is to be preferred, especially as one of the study sites in this report, Helsington Barrows, is specifically mentioned by Whittow (1984) as an example of a shillow area.

Shillow is distinct from scree or talus in two important ways. Firstly, accumulations are relatively thin compared with scree accumulations, often not covering the whole slope. This means that the angle of rest of the shillow fragments is controlled by the underlying slope angle. Secondly, there is no headwall or free face above the slope as for scree. Consequently, production of shillow can occur all along the slope, provided there are exposed beds. Movement of shillow is not influenced by rockfall but restricted to sliding and other creep processes. In addition, individual shillow fragments move more or less independently of one another.

Fieldwork was done in the southern part of the County of Cumbria, northwest England, on several isolated easterly dipping fault blocks of Carboniferous limestone (Figure 1).

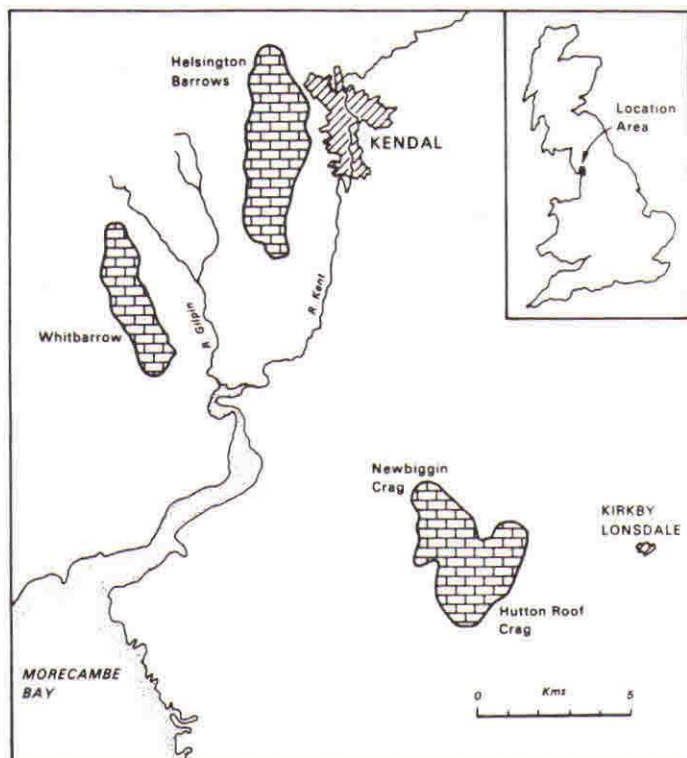


Figure 1

Measurement was made of the three principal axes and the weight of 1350 shillow fragments from nine slopes on four limestone fault blocks. A tape was laid along the maximum slope and sampling lines laid out perpendicular to the maximum slope at  $1/5$  of the slope distance. Thirty shillow fragments from each sampling line were chosen at intervals of 5 cm or the nearest multiple thereof. This resulted in the sampling of 150 shillow fragments for each of the nine slopes.

The strike and dip of the bedrock was measured at several places on each slope and these were averaged to give a strike and dip for the slope. The maximum slope angle and the slope length in this direction was also measured. For all slopes, the maximum slope angle is greater than the bedrock dip. Using a standard alignment diagram for apparent dip, the above measurements made it possible to calculate the stratigraphic thickness exposed along each slope:

$$E = L \sin (S-A),$$

Where  $E$  = stratigraphic exposure in m,  $L$  = length of slope in m,  $S$  = slope angle, and  $A$  = apparent dip of bedrock.

## Shallow shape and bedrock

On the whole, the shape of the shallow fragments is bladed. Figure 2 shows the means of the intermediate/long axes ( $I/L$ ) and short intermediate axes ( $S/L$ ) ratios for the nine slopes plotted on a Zing (1935) diagram with Krumbein (1941) sphericity values.

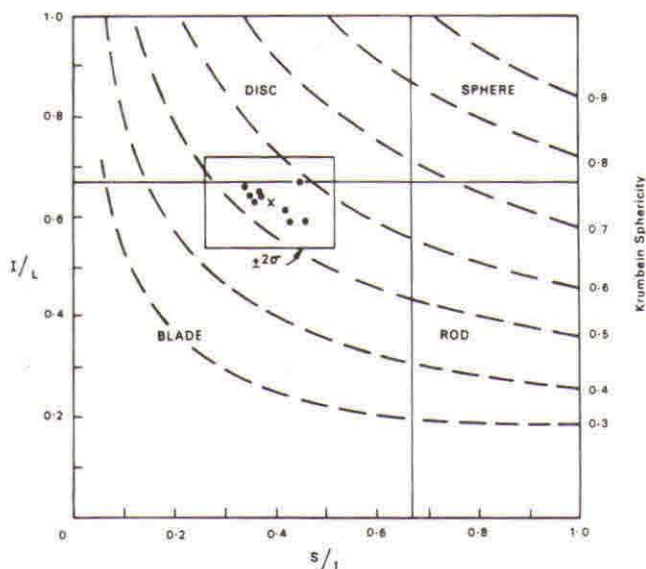


Figure 2

one or a small number of beds. Consequently, the mean short axis dimension will be minimum. As the angle between the bedrock slope and the apparent dip in the direction of slope increases, more beds will be exposed and each exposure will consist of a larger number of beds. Consequently, the mean short axis dimension will increase — with more fragments which are two or more beds thick. Figure 3 shows the relationship between the mean short axis dimension and the stratigraphic exposure (the 'E' index), the latter being a measure of the number of beds exposed along the slope. The correlation coefficient of +0.72 is significant at the 0.01 level.

The log-log correlations between E and other characteristics and parameters dependent on the short axis are also reasonably strong: viz. for weight,  $r = +0.66$ ,  $p < 0.03$ ; for  $S/L$ ,  $r = +0.55$ ,  $p < 0.06$ ; for Cailleux' flatness,  $r = -0.59$ ,  $p < 0.05$ . On the other hand, the relationships between E and factors not dependent on the short axis (intermediate axis, long axis,  $I/L$  ratio) are weak and not statistically significant. Also, there are no good correlations between bedrock slope angle and any of the above factors.

Shallow shape is controlled by joint geometry & bedding-plane spacing, and shallow fragments are produced from the edges of beds exposed on the bedrock slope. The long and intermediate axes result from the two major joint sets. The short axis is delimited by bedding planes and may be one or more beds thick. If the bedrock angle is near to the apparent dip in the direction of slope, few beds will be exposed along the slope and each exposure will consist of



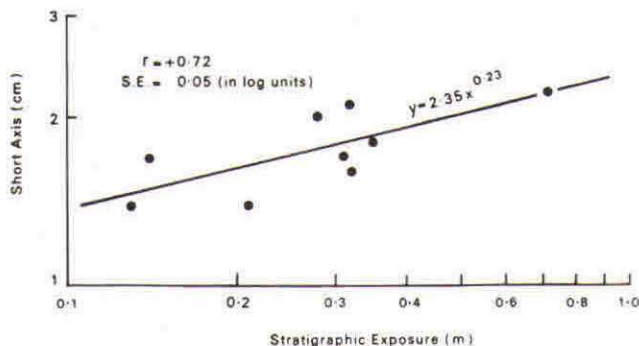


Figure 3

### Shallow size and shape downslope

Any change in the size or shape of shallow fragments along the slope will be a reflection of different rates of movement of the different sizes or shapes of fragments. It can be assumed that, for any one slope, all different sizes and shapes will be produced in the same proportions on every part of the slope. This is not strictly true since fragments will be produced at the edges of exposed beds, but it should be statistically true over time as the edges of beds recede upslope as shallow fragments are produced. In the dynamics of fragment movement, there are two other factors to consider: (1) continual production of fresh fragments all along the slope while previously produced fragments are moving downslope; and (2) diminution of fragments while they are moving, probably mostly by solution.

Figure 4 shows the pattern of change downslope for the three major axes and weight. All four values are smallest in the middle of the slope. Assuming continual production of all sizes of fragments all along the slope, this condition can best be explained by different rates of movement of the different sized fragments — specifically, if the rate of movement of the larger fragments is greater than the rate of movement of the smaller ones. This is similar to the kind of movement rate that has been shown to occur on scree slopes when fragment movement is due to sliding (Statham, 1973) and results from the fact that smaller fragments are more easily trapped by slope irregularities whereas larger fragments can bridge these irregularities.

With continual production of all sizes all along the slope, and with the rate of movement of the larger fragments greater than the rate of movement of the smaller, and with NO decrease in the size of the fragments on the slope; then the mean size of fragments will first decrease toward the middle of the slope and then increase toward the bottom of the slope such that the mean size at the bottom will be larger than the mean size at the top. However, Figure 4 shows that the mean weight (size) at the bottom of the slope is LESS THAN the mean weight at the top. This condition can be met by a constant proportional decrease in the size of all fragments on the slope, i.e. where the decrease in size of each fragment is a constant percentage of its volume (or weight).

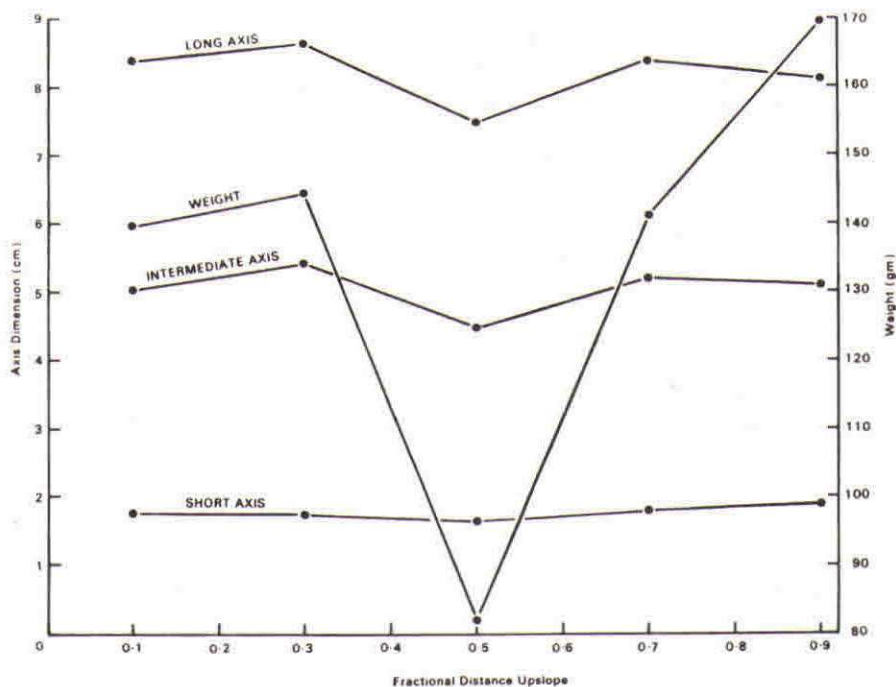


Figure 4

The change in axial dimensions downslope shown in Figure 4 is such that the percentage decrease of the short axis from top to mid-slope is greater than the percentage decrease of the intermediate or the long axis. (About 16% for the short axis, 12% for the intermediate and 7% for the long). This suggests that the short axis is being preferentially decreased as the shillow moves downslope. Solution of the shillow is bound to play a large part in size decrease and it is reasonable to attribute maximum solution to the underside of the shillow where moisture is retained for longer periods and solutational attack by slope wash is more frequent. In addition, decaying biota on the damp underside of shillow fragments would enhance the solution rate there due to greater  $\text{CO}_2$  availability.

### Acknowledgements

I thank Mr P Bell for helpful assistance in the field, Mr M Frank for writing computer programs used in analyzing the data, and Dr J Milne for reading the manuscript and offering useful criticisms.



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## REPORTS

### DISCUSSION MEETING: PAST AND PRESENT SOIL EROSION — 15 May 1991

Institute of Archaeology, University of London

A one day Discussion Meeting was sponsored by the Quaternary Research Association and the Association for Environmental Archaeology and organised by Martin Bell (Lampeter) and John Boardman (Oxford). The aim of the meeting was to bring together archaeologists, geomorphologists and soil scientists for an exchange of information on a topic of concern to these disciplines. About 100 people attended the meeting, 15 papers were presented and several poster papers displayed.

Contributors to the first session ('Field studies in Britain') attempted by varying degrees to use knowledge of erosional processes to explain erosion in the past. Bob Evans (Cambridge) concentrated on upland erosion; John Boardman, Martin Bell and Mike Allen (Trust for Wessex Archaeology) on chalk and limestone landscapes in southern England; John Catt (Rothamsted) on the sandy soils of the Lower Greensand and Tony Brown (Leicester) on colluviation at the floodplain edge in the East Midlands.

In a session on 'Analytical techniques', Tim Quine and Des Walling (Exeter) discussed the potential of the Caesium-137 technique, Richard Macphail (London) and Paul Farres (Portsmouth Polytechnic) discussed micromorphological examination of soil and colluvial materials and Richard Preece (Cambridge) presented recent results of dating colluvial sequences from the Channel Tunnel entrance site at Holywell, Folkestone.

The final session was devoted to erosion in the Mediterranean region. Eberhard Zangger (Cambridge) summarised the history of erosion in Greece, arguing that the first phase of Holocene erosion was the most significant in terms of quantity of soil moved. John Bintliff (Durham) reviewed the history of Mediterranean erosion research, emphasising recent methodological and conceptual developments and John Wainwright (Bristol) demonstrated the use of computer models for simulating artifact and soil movement at archaeological sites. The results of soil erosion mapping in Greece were presented by Donald Davidson (Stirling) and the development of agricultural terraces in Cyprus was discussed by Malcolm Wagstaff (Southampton).

There were poster papers from Louise Heathwaite (Sheffield) and Tim Burt (Oxford) on past and present erosion at Slapton, Devon; Steve Ellis (Hull) on erosion on the Yorkshire Wolds; Rebecca Roseff (Birmingham) on post-Medieval erosion on Welsh uplands; Brigitte van Vliet-Lanoe (CNRS, Caen) on loess erosion in north-west France; Duncan McGregor (Royal Holloway) on erosion in Jamaica and Steve Carter (Edinburgh) on archaeological research in Scotland.

Discussion ranged over several issues of general interest such as the role of large rainfall events; the use of average values in expressing quantities of erosion and the definition and origin of colluvium. A critical issue which

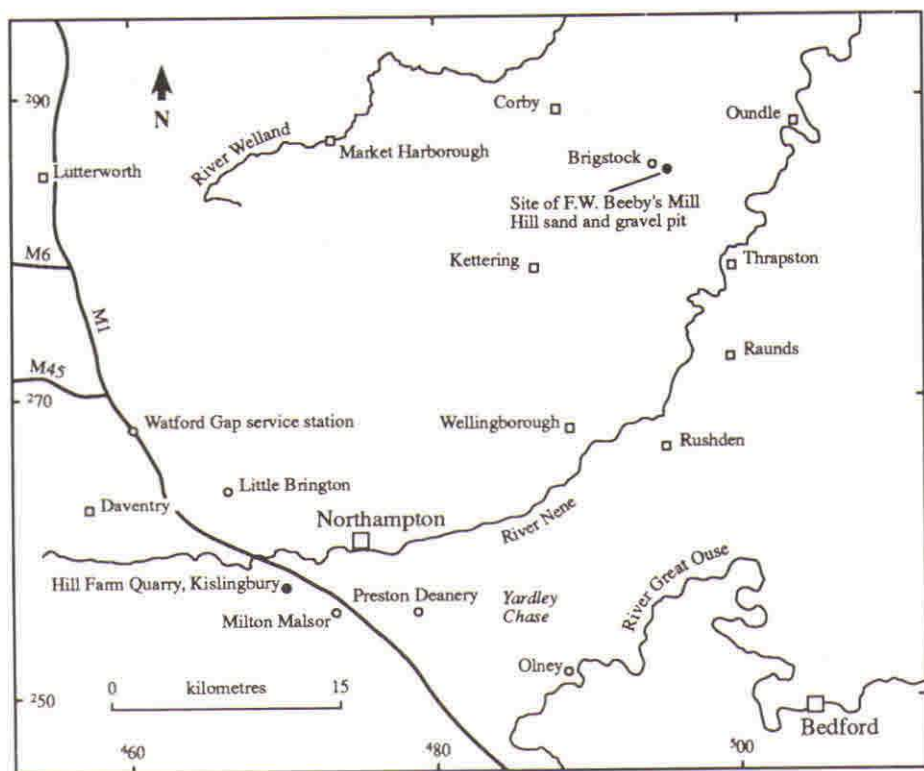
emerged from discussion of several papers was differing perceptions of the comparison between past and present erosion rates. Some felt that present rates were substantially greater than those in the past, whilst others emphasized past phases of apparently greater erosion. The conference papers together with six additional contributions will be published by Oxbow Books (Oxford) in 1992.

John Boardman and Martin Bell

## **REPORT ON THE ONE-DAY FIELD MEETING TO NORTHAMPTONSHIRE, 17 APRIL 1991: THE MILTON SAND AND ASSOCIATED DEPOSITS**

The presence of fluvatile sands underlying chalky till (the 'Chalky Boulder Clay' of Hollingworth and Taylor, 1946; Taylor, 1963; 'Upper Boulder Clay' of Castleden, 1980) in the Northampton district has been known since the late nineteenth century, largely as a result of the work of the pre-eminent Northamptonshire geologist, Beeby Thompson (Thompson and Crick, 1891; Thompson, 1929-1930). The so-called Milton Sand (Horton, 1970) is characterised by the presence of local erratics (i.e. Jurassic ironstone and limestone), although flint, chalk and 'Bunter' clasts, common constituents of Midland glacial deposits, are absent. In many respects similar to the Baginton-Lillington sands and gravels of the West Midlands, the Milton Sand is distinguished by its occurrence at a higher altitudinal level and, despite having the appearance of a sand derived from the Triassic deposits of the Midlands, the fact that it is devoid of 'Bunter' pebbles. The gravel lithology is totally local in derivation, although conversely the sand component is too coarse to be derived entirely from local material. Given this background the purpose of the one-day field meeting, organised and led by Roger Belshaw of Nene College, Northampton (who with his third year undergraduate students has been investigating this enigmatic suite of sands), was to examine exposures of the Milton Sand and to discuss its provenance, mode of deposition and relation to other Pleistocene deposits in the English Midlands.

A party of eight people assembled by the A508, just north of Junction 15 of the M1, where Roger Belshaw outlined the history of research into the Milton Sand and described its sedimentological characteristics and distribution. The deposit forms a fragmented belt west and south of Northampton, extending from near the Watford Gap service station to Preston Deanery, where it disappears beneath the thick chalky till sheet of Yardley Chase. Castleden (1980) has recorded a drift-filled buried valley beneath Yardley Chase, extending from near Preston Deanery to Olney in the valley of the Great Ouse and considered it an extension of the 'Milton Sand valley', thus supporting Thompson's (1929-1930) belief that the river that deposited the Milton Sand flowed east-south-eastwards, crossing the present-day Nene-Ouse watershed to join the Great Ouse near Olney.



Passing by sites of former sand pits around the village of Milton Malsor (which lends its name to the deposit), the party drove to Hill Farm Quarry (SP 702573), Kislingbury, where the morning was spent examining the excellent sections displaying Milton Sand overlain by gravels and capped by the 'Chalky Boulder Clay' (Lowestoft Till). At this locality the cross-bedded sand contains gravel stringers and lenses almost totally comprised of locally-derived ironstone. Palaeocurrent measurements confirmed a south-easterly flow direction, previously observed at other Milton Sand localities. A search of graded spoil material for vertebrate remains proved unsuccessful but emphasised the abundance of ironstone in the gravel component of the deposit.

Following lunch at Ye Olde Saracen's Head, Little Brington, the party departed for Brigstock, near Corby, where sands similar to those present at Kislingbury, 38 km to the south-west, were formerly exposed at F W Beeby's Mill Hill sand and gravel pit (now part of Brigstock Country Park). Previously described by Richardson and Kent (1938), Hollingworth and Taylor (1946), Taylor (1963) and mentioned by Harrison (1981), this important locality has recently been re-investigated as part of an undergraduate dissertation study by Graham Hackney (Anglian Water). This work (Hackney, 1989) has

demonstrated a probable link between the pre-glacial sands of the Brigstock area and those in the Northampton district and adds further support to the view that a large river system existed in this part of the Midlands prior to the 'Chalky Bounder Clay' glaciation. Palaeocurrent directions and sedimentological characteristics of the sands at Brigstock and the Milton Sand are very similar. Despite the overgrown nature of the sections a thought-provoking discussion took place, concentrating on the possible age and extent of this fluvial deposit and its relation to the Baginton-Lillington sands and gravels (Rose, 1989).

Additional interest at the Brigstock site is provided by two distinct tills overlying the sands. The lowermost till, the 'Lower Boulder Clay' of Hollingworth and Taylor (1946), Sabine (1949) and Taylor (1963), is a dark grey clay characterised by 'Bunter' and local limestone clasts but devoid of chalk and flint pebbles. The overlying 'Chalky Boulder Clay' is more widespread in the district and is widely thought to be a product of the Anglian glaciation (Perrin, Rose and Davies, 1979). Davey (1991) has recently drawn attention to the need for a detailed study of the tills in the district.

It is thought that the Brigstock deposits represent a further example of the predominantly W-E trending drift-filled pre-glacial channels recorded elsewhere in the East Midlands. Kellaway and Taylor (1953) located numerous sub-drift channels on the Nene-Welland watershed north of Kettering while Wyatt (1971), extending Kellaway and Taylor's work in the north, found evidence for a major drift-filled valley system between Melton Mowbray and Thurlby. These sub-drift channels follow the regional dip of the Jurassic bedrock surface and are likely to represent remnants of a very early drainage system in existence prior to the 'Chalky Boulder Clay' glaciation (Anglian?).

It is disappointing that so few attended this stimulating meeting, since the work of Roger Belshaw and successive generations of final year undergraduates at Nene College clearly has major implications for our understanding of the evolution of Midland England during late Neogene and early Pleistocene times. The published results of this work are eagerly awaited by all those with an interest in the Pleistocene fluvial history of the English Midlands.

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Nicholas D W Davey  
 Earth Science Branch  
 Joint Nature Conservation Committee  
 Monkstone House  
 City Road  
 Peterborough PE1 1JY

# ABSTRACTS

## Thesis abstracts



### Scottish Lateglacial Moraines: Debris Supply, Genesis and Significance

Douglas I Benn

PhD, University of St Andrews, October

This thesis presents detailed case studies of moraines in geologically and topographically contrasting areas on the Island of Skye, Scotland. Geomorphological mapping, sedimentological analyses and mathematical modelling techniques were employed to determine the principal controls on moraine morphology, composition and distribution. Particular emphasis was placed on the provenance, transport and deposition of debris, and their spatial variation. The results were used to construct a summary model of glacial landform evolution, which relates different sediment-landform associations to spatial and temporal controls, particularly basin lithology and structure, topography, position of deposition and ice-margin activity.

The initial stage of deglaciation in the study area was marked by a series of readvances and/or stillstands. During this stage, the lower-lying glaciers were more sensitive to climatic amelioration than the higher glaciers. The subsequent phase was characterised by more rapid deglaciation. Evidence for one instance of late-stage *in situ* glacier stagnation is described.

The results indicate that landforms hitherto grouped as 'hummocky moraine' actually formed by a variety of processes. Such moraines formed by (a) uneven deposition of supraglacially and/or subglacially-derived debris at active ice margins; (b) deposition at the stagnant margins of otherwise active glaciers; and (c) deposition during uninterrupted glacier retreat or areal stagnation. Differentiation and analysis of so-called 'hummocky moraine' enables glacier behaviour during the Lateglacial to be interpreted in great detail.

### Blanket Mires and Climatic Change: A palaeoecological study based on peat humification and microfossil analysis

Jeff Blackford

PhD, University of Keele

The aim of this thesis is to evaluate the role of blanket peats as a source of proxy data by examining various properties of the peat and comparing the results with climatic changes known or inferred from other sources.

Blanket mires from the North York Moors, England, Connemara, Western Ireland and Snowdonia, North Wales, were chosen to cover a range of current climatic conditions.

The humification degree of peat was measured by a revised version of a previously used colorimetric technique. The method was reviewed and tested, showing that optical transmission values were indicative of, and proportional to, but not an exact measure of, the degree of humification.

Pollen and non-pollen microfossils, including previously unrecorded fungal, algal and unidentified remains, were counted and compared with the humification data. Horizons showing evidence of a change to wetter conditions were radiocarbon dated.

Detailed palaeoecological analysis across inferred wet-shifts demonstrate the nature of the changes and, in some cases, possible causes. In some examples the palaeoecology of blanket mires appears to have been dominated by the impact of man. However, synchronous increases in peat-surface humidity are recorded from all the areas studied, although not from every profile. Some microfossils show a different ecological preference from that found in previous studies. An attempt is made to model the response of blanket mire systems to different changing variables, and hydrological implications are discussed.

Coincident wet-shifts are inferred for the period around 1500 BC, between 1000 and 750 BC, between 400 and 200 BC, and around AD 650. Further periods of increased mire-surface wetness are recorded at AD 1150–1200, AD 1520–1600 and AD 1730–1800.

Blanket mires appear to have some of the properties required of a source of proxy climatic data.

PS

Jeff Blackford is now employed on a Leverhulme Research Grant, based in the School of Geography, University of Birmingham.

# Holocene vegetation history of the Western Isles, Scotland

Julie A Fossitt

PhD, Department of Quaternary Research,  
University of Cambridge

The Holocene vegetation history of the Western Isles of Scotland is reconstructed from four dated lake sediment sequences. In contrast to the present treeless landscape and previously published pollen diagrams, it is shown that woodland cover was extensive in the past and regional patterns of vegetation development were apparent at an early stage. Lateglacial vegetation was a mosaic of *Empetrum* heath, herb-rich grassland, juniper and *Salix* scrub, and *Huperzia selago*. Woodland expanded at all sites in the early Holocene. In western Lewis, birch woodland was widespread but discontinuous from 9700 to 7900 BP. Following a sudden reduction in tree cover at 7900 BP, vegetation on the exposed western margin was open and supported localised patches of woodland in a landscape otherwise dominated by blanket peat. Open birch-hazel woodland dominated vegetation of the sheltered central and eastern regions from 9000 to 4000 BP. Woodland diversity increased after 7600 BP as oak and elm expanded, and pine, alder and ash became established over the following 2000 years. Stands of mixed woodland were localised and dominated the most favourable sites for tree growth. Woodland decline began between 5000 and 4000 BP and was a gradual process which coincided with a regional expansion of blanket peat. Both are attributed to a multiplicity of factors including human disturbance and grazing pressure, changes in climate and hydrology, natural pedogenic processes and rising sea levels. The Western Isles were predominantly treeless at 2000 BP and oak, elm, alder and pine became extinct.

An investigation of modern pollen rain is based on surface sediments from a network of 47 small lakes (less than 5 ha) and demonstrates that pollen production on remote and treeless Scottish islands is high. An average of only 14% of the pollen rain on the Western Isles and 11% on Shetland is long distance in origin. Inter-site variation in the long distance component is considerable and depends on local site characteristics and pollen recruitment capacity rather than location, distance from mainland pollen sources or degree of exposure. Small lakes record mainly regional aspects of the vegetation.

Subfossil wood remains preserved in peat have extended the former range limits for tree growth on the Western Isles in general, and of pine on Lewis and Harris. Trees colonised virtually the entire area of the islands, including exposed sites on the western coastal fringe, for at least a short interval during the Holocene. Wood remains of alder confirm its former presence. Thirteen radiocarbon dates for wood are used in conjunction with pollen records to determine the relationship between wood remains preserved in peat and former

woodland cover. Dated wood remains show a distinct bimodal distribution on remote Scottish islands with peaks at 8000 BP and 5000 to 4000 BP and these correlate with woodland decline, blanket peat expansion and conditions favouring preservation. Subfossil wood remains are a poor representation of maximum woodland development of individual trees, as those growing under sub-optimal substrate and climate conditions are most likely to be preserved.

## **The palaeogeography of the Chelford interstadial, Cheshire**

**Frances Green**  
PhD, University of Nottingham

New exposures of the organic deposits at Oakwood East sand quarry near Chelford, Cheshire (SJ 826 717) have enabled a detailed palaeogeographic reconstruction of this important Interstadial.

Borehole data establishes the confinement of the organic deposits to a palaeochannel, the position of which is influenced by a deeper bedrock-cut palaeovalley. Sedimentological studies of the Chelford Sands Formation, in which the organic deposits are found, reveal three separate facies associations, representing deposition before, during and after the Chelford Interstadial. Palaeobotanical records from several sites in close proximity to each other allow a three dimensional image of the former vegetation to be described. A mature Pinus, Betula and Picea forest was able to develop in the drier areas but other parts were subjected to frequent flooding events. Palaeoclimatic inferences obtained from the pollen data were limited but tree ring studies provides evidence of significant annual variation in temperature and a probable deterioration of climate at the end of the forested stage. Away from the confines of the abandoned palaeochannel, pollen of Bruckenthalia spiculifolia is found in abundance and suggests the presence of an open Ericaceous heath.

Modern pollen analysis from surface samples across Fennoscandia help establish a modern analogue for the Chelford Interstadial forest within the northern boreal forests of Finland.

Thermoluminescence dating of the Chelford Sand has confirmed the suspected Early Devensian age of the deposit (90-100 Ka BP) and corroborated correlations with the St Germain I (Brörup) Interstadial of the European record.



# AWARDS

## The QRA's Awards to Young Research Workers 1992

### 1 Purpose

To assist young research workers with field and/or excavation expenses, or to help to defray costs incurred by young research workers who are giving papers at conferences.

### 2 Eligibility

Grants (not normally exceeding £100) will be made to postgraduate students who are currently registered for a higher degree and who are members of the Quaternary Research Association of at least one full year's standing. Preference will be given to those who have no source of fieldwork or conference funding, or whose access to such funds is limited.

### 3 Applications

Applications (two copies) should be sent to the Chairman of the QRA Research Grants Committee (see below). They should set out clearly the purpose for which the award is intended, and should contain full details of all sources of funding to which the applicant has access. The name of an academic referee, to whom the Committee will make reference, should also be included. Applicants should note that these awards are essentially contributions towards research and would not normally be expected to cover the whole costs of a project/conference.

The deadline for submission of applications is 15 March 1992.

### 4 Successful applicants

Successful applicants will be informed approximately four weeks after the AGM and will receive their grants shortly afterwards. Please note that successful applicants will be expected to submit a brief (300–500 word) report to the Committee on the project for which the award was made. This report should be in a style suitable for inclusion in the Quaternary Newsletter where it will appear. Receipt of the grant should be acknowledged in any future publications, a copy of which should be sent to the Committee.

Dr J E Gordon  
Chairman  
QRA Research Grants Committee  
Nature Conservancy Council for Scotland  
2/5 Anderson Place  
Edinburgh  
EH6 5NP

## REPORT OF VISIT TO NORWAY APRIL 1990— partly funded by the QRA

In April 1990, immediately after the QRA North Wales field meeting, I travelled to Norway to spend a week at the Geological Institute, University of Bergen. The visit, which was partly funded by an award from the QRA, had specific objectives to measure alle/Ile ratios in picked, monospecific samples of foraminifera obtained from British Geological Survey cores from two UK offshore localities:

(a) Proposed Late Devensian glacial marine diamicts from offshore SW Britain (cf. Scourse et al., 1990).

(b) Proposed Hoxnian interglacial marine silts and clays from borehole 81/52A, Sand Hole Formation of the Inner Silver Pit, southern North Sea.

A single sample (BAL 2120) from vibrocore 49/09/44, southern Celtic Sea, yielded an alle/Ile ratio of 0.039 from a monospecific sample of 200 small tests of the benthic foraminifera *Elphidium excavatum* (Terquem) forma *clavata* Cushman. This ratio, based upon a taxon of arctic affinity within an assemblage characteristic of glacial marine environments, falls within group 1 of Knudsen and Sejrup (1988) based upon ratios from the same species in the North Sea area. The latter propose that group 1 ratios, typically between 0.03 and 0.04, are characteristically of the Late Weichselian of the area as did earlier studies on the Norwegian continental shelf (Sejrup et al., 1984) and from onshore western Norway (Miller et al., 1983). Therefore, even allowing for the fact that the site under investigation is some distance from the North Sea and that an inter-regional temperature gradient may play a slight role in the rate of the isoleucine epimerization reaction over a possible short geological period, it seems reasonable to correlate this ratio with those of group 1 and therefore to propose that glacial marine conditions did exist offshore SW Britain during the Late Devensian. Further investigation is now required to relate the sediments of VE 49/09/44 to those reported by Scourse et al. (1990) in which a grounding line in this area has been proposed.

A further ratio from a monospecific sample of *Elphidium excavatum* (Terquem) forma *clavata* Cushman was obtained from BGS borehole 81/52A and yielded an alle/Ile value of 0.29. There seems to be good palynological evidence for correlating these interglacial deposits with those from the onshore Hoxnian sequence in the Nar Valley (M Ansari, UCNW, pers. comm.). However, this ratio is anomalously high for the Hoxnian; Knudsen and Sejrup (1988) quote typical ratios close to 0.145 for their Holsteinian group 3. The presence of this species within the core at the same level as interglacial zone 3 of the pollen diagram may also appear anomalous, since it is a typical constituent of shallow arctic assemblages. However, it is interpreted here to be responding to lowered salinities rather than an indication of a cold climate. The possibility that these high ratios are in fact the result of reworked material,

bearing in mind that any one ratio is the product of a mean value based upon over 100 individuals, should be kept in mind. Here again further samples are required before this site can be properly correlated with others from the North Sea area.

Preliminary investigations of the amino acid signatures of Recent marine Ostracoda, recovered in surface grabs from the western Irish Sea in July 1989, aboard the RV Prince Madog, were also undertaken during this visit. The results of these measurements are promising and as a result of this visit I was able to apply and have been successful in obtaining funding from the Royal Society for a Post-doctoral fellowship to visit Bergen from October 1991.

I would like to thank Hans Petter Sejrup, his family and staff, particularly Vigdis Hope, at the Institute of Geology, University of Bergen for their hospitality and for making my visit an enjoyable one. I also thank the British Micropalaeontological Society and the Research Committee at UCNW for financial support. James Scourse and Murtaza Ansari provided samples and much useful discussion. Finally, I would like to thank the QRA and particularly Dr Pete Coxon, the then chairman of the Research Grants Subcommittee, for their support.

Bill Austin  
School of Ocean Sciences  
University College of North Wales  
Menai Bridge  
Gwynedd  
LL59 5EY

## **BEVERLY HALSTEAD**

### **'DARWIN'S TERRIER'**

Members may be interested in subscribing to the Halstead Trust — details of which are appended below

#### **THE HALSTEAD TRUST**

Many people have expressed a wish to commemorate Beverly Halstead in a way that would reflect his concerns and enthusiasms. At the time of his death on April 30th, he was President of the Geologists' Association. Accordingly, the Geologists' Association has instituted the Halstead Trust, a fund which will be used especially to help young palaeontologists and geologists who could not otherwise gain financial support for their projects or travel plans.

The Trust depends upon donations, which will be most welcome from anyone. Donations should be sent to "The Geologists' Association (Halstead Trust)" at the address provided below.

We hope in this way to carry on the kinds of activity of which Beverly would have approved.

Eric Robinson  
President, Geologists' Association  
Burlington House  
Piccadilly,  
London, W1V 0JU

## A PERSONAL NOTE ABOUT BEVERLY HALSTEAD

I would like to add, if I may, a further comment to Peter Worsley's wonderful memorial tribute to Beverly in the last edition of the Quaternary Newsletter. Peter described Beverly's enthusiasm for the East Anglia field trip and the wide range of activities which became included in "Quaternary geology".

As Beverly's partner for the last five years, I got drafted into these field trips as driver and general factotum (at no cost to Reading University, I may say!). I have to say that as well as railways, radical history was also part of the agenda. We always stopped at both Tom Paine's statue in Thetford, and at the Burston Strike School. This reflected Bev's passionate concern with the history of the struggles for the rights of ordinary people. Those who have read Bev's writings will know that he saw important links between politics and the history of geology.

But something that Peter alluded to, I want to extend. The numbers of students were indeed cut drastically in recent years: we only took very small groups of students to East Anglia during the last four years. Yet despite the small group size, Beverly put as much energy into the course as others would for ten times that number. Only six weeks before he died was the last field trip, with a student who has a severe visual impairment. To run a field course to cope with such a disability requires great patience and ingenuity (much was resolved by using a Polaroid camera). Beverly had both.

Helen Haste



## PALAEOCLIMATE OF THE LAST GLACIAL/INTERGLACIAL CYCLE – a NERC Special Topic

The NERC (Earth Sciences Directorate) Special Topic on the "Palaeoclimate of the Last Glacial/Interglacial Cycle", launched in 1989, will shortly be commencing its second year of funding. Two rounds of funding have been held. Some approved projects will continue into 1993, and it is planned that a "round-up" meeting will be held in September 1993.

The Special Topic arose out of the 1987 Report of the Expert Group Review of Quaternary Science chaired by David Bowen. Discussions are already commencing to formulate proposals for new Quaternary Science-related Special Topics to follow the Palaeoclimate Special Topic, the funding for which is now closed.

The first round of the Palaeoclimate ST was notable for the considerable number (37), the high quality and the diversity of applications received. The second round attracted fewer applications, but the majority were still of high quality, and as a result it proved possible to fund a mixture of both new and re-submitted proposals from the first round. In both rounds some originally independent applicants were asked to re-submit combined proposals (i.e. they were steered by the ST Steering Committee), and it is pleasing to report that all were eventually funded via the round to which their unsteered applications had been made.

The grants awarded in connection with the Palaeoclimate Special Topic were:

### First Round

R W Battarbee: Diatom/water chemistry transfer functions for salinity, water-level and climate reconstruction.

(1990–1993, c.£13,500)

G S Boulton: Changes in mid-latitude ice sheets as indices of climatic evolution through the last glacial period.

(1990–1991, c.£49,500)

W G Chaloner & M J Tooley (cooperative award): The response of plants to changing CO<sub>2</sub> by measuring stomatal density of fossil leaves as a record of linked climatic-atmospheric changes through a glacial/interglacial cycle.

(1990–1992, c.£41, 000)

B A Maher: Use of mineral magnetic records from the Late Quaternary loess-palaeosol sequence in N China for palaeoclimatic reconstruction.

(1990–1992, c.£44,500)

T M L Wigley: The thermal climate of the Holocene in Scandinavia: a reconciliation of different proxy evidence.

(1990–1992, c.£49,500)

B Huntley, G R Coope, D H Keen & J J Lowe (cooperative award): Devensian Late Glacial Palaeoclimate.

(1990–1992, c.£114,500)

## Second Round

- K E Barber & F M Chambers: Spatial and temporal variability of Late Holocene palaeoclimates derived from peat stratigraphy.  
(1991-1993, c.£42,000)
- E Derbyshire, J Shaw & A Wintle (cooperative award): Loess-palaeosol sequences as recorders of palaeoclimatic variation during the last glacial-interglacial cycle in central China.  
(1991-1993, c.£93,000)
- N H Gale, J Thompson & P P E Weaver: Development and application of mass spectrometric U-series dating of deep-sea cores and its inter-comparison with  $^{14}\text{C}$  AMS dating for palaeoclimate analysis.  
(1991-1993, c.£68,000)
- H F Lamb & C N Roberts: Fine resolution analysis of abrupt hydro-climatic events recorded in lake sediment cores from extra-tropical North Africa.  
(1991-1992, c.£40,500)
- F Oldfield, P G Appleby, A J Plater & J Bloemendal: The geochronology of the last millenium  
(1991-1992, c.£32,500)
- D E Sugden, C M Clapperton & R G Healey: Modelling glacier fluctuations in Patagonia to reconstruct palaeoclimate during the last 80,000 years.  
(1990-1992, c.£42,500)
- M A Pollard, R V Switsur, J Pilcher, K D Bennett, J S Waterhouse & T H E Heaton (cooperative award): Stable isotope studies of recent Oak chronologies for palaeoclimatic reconstruction.  
(1991-1993, c.£127,500)

In addition the following projects, originally submitted to the Palaeoclimate ST in response to the First Round Announcement of Opportunity, were subsequently funded by Main Grants Committees.

- C M Clapperton & D E Sugden: Last glacial/interglacial cycle in Patagonia; combined glaciological modelling/palaeo-environmental approach.  
(1990-1992, c.£50,000)
- N H Gale: Mass spectrometric uranium disequilibrium dating; a new dating method for palaeoclimatological research.  
(1990-1992, c.£15, 000)
- P L Gibbard, B Huntley, & R G West: Palaeoclimate and vegetation changes during the Last Interglacial in Europe.  
(1990-1992, c.£66,000)
- J A Johnson: Modelling of palaeo-ocean circulation.  
(1990-1992, c.£32,000)
- F A Street-Perrott: Abrupt climatic changes; evidence from closed lakes in the montane rain forest of East Africa.  
(1990-1992, c.53,000)

R Thompson: Palaeoecological evidence from the south-central North Sea for sea-level rise and vegetational development following the last glaciation.  
(1990-1992, c.£78,000)

All the projects supported by the Palaeoclimate ST contribute to one aspect or another of the International Geosphere-Biosphere Programme (IGBP): Past Global Changes (PAGES) Core Project.

Altogether c.£1,000k of funding has been committed to Quaternary Palaeoclimate research during the last two years as a result of the NERC Palaeoclimate Special Topic initiative. Reviews of the results of this research will appear in the QRA Newsletter from time to time. A short selection of recent publications arising from some of the topics currently funded is appended below.

Finally, as chairman of the ST Steering Group, I would like to thank all the applicants, all the members of the Steering Group, all the referees, and last but not least Lin Kay (NERC, secretary to the ST), and Jim Briden (NERC, Earth Sciences Director), for all their efforts that have got the ST off to such a promising start.

Brian Funnell (Norwich)  
August 1991

#### Publications

- Boulton, G S, and Clark, C D. 1990. A highly mobile Laurentide ice sheet revealed by satellite images of glacial lineations. *Nature*, 346, 8130-8170. (Comment: Dowdeswell, J A, *Ibidem*, 795-796.)
- Briffa, K R, Bartholin, T S, Eckstein, D, Jones, P D, Karlen, W, Schweingruber, F H, and Zetterberg, P. 1990. A 1,400-year tree-ring record of summer temperatures in Fennoscandia. *Nature*, 346, 434-439.
- Fritz, S C, Juggins, S, Battarbee, R W, and Engstrom, D R. 1991. Reconstruction of past changes in salinity and climate using a diatom-based transfer function. *Nature*, 352, 706-708.

# ANNOUNCEMENTS

## CONSERVING OUR LANDSCAPE: EVOLVING LANDFORMS AND ICE AGE HERITAGE

Conference at Crewe, Cheshire: 14-17 May 1992

### Registration and call for papers

This wide-ranging conference will consider all aspects of the conservation of landforms and Quaternary features. It will consist of a single day of presentations followed by two days of field-based studies and discussions. Subjects will include the conservation of:

- \* River systems and coastal features.
- \* Man-made exposures and mineral extraction sites.
- \* Upland landscapes and deposits.

The legislative framework, voluntary conservation initiatives and links with wildlife and archaeological conservation will form important cross themes to the subjects listed above.

The conference is organised jointly by the Geological Society, Quaternary Research Association, British Geomorphological Research Group, Royal Geographical Society, Nature Conservancy Council for Scotland, Countryside Council for Wales and English Nature.

### Venue and accommodation

The Peak District and Cheshire Plain have been chosen as the focus for the conference, which will be based at Crewe to take advantage of its excellent road and rail links. Hotel accommodation and transport will be arranged in or near Crewe for delegates. Alternatively, bed and breakfast accommodation is available in Crewe for those wishing to make their own arrangements. Details and costs are given on the registration form.

### Field visits

The two day programme of field visits will include:

- \* Active river systems.
- \* Disused mineral workings in Pleistocene deposits.
- \* Coastal sections.
- \* Upland landforms and deposits.
- \* Landslips and engineering impacts.
- \* Karst and caves.

Visits and discussions will be led by experienced practitioners in geomorphology, Quaternary science and conservation. There will be input by land management agencies, engineers and archaeologists. The field trips will form a major part of the conference and would be designed to allow time for debate and discussion. Supporting documents will be provided.

## Papers and presentations

Delegates wishing to put forward papers on any aspect are requested to fill in the form (previously circulated to all QRA members) and return it, with the abstract, by the end of November, 1991. The deadline for final submission of papers is 1 March 1992, to enable the papers to be copied and distributed in advance of the meeting. It is intended eventually to publish the papers, although this will depend on the response. It is proposed to seek sponsorship for publication. Authors will be expected to attend the presentation session, and give a resume or enlargement of the paper, taking the paper as read by the delegates. All normal audio/visual aids will be available. There will also be an opportunity for a poster display.

## Outline programme

Thursday, 14 May	1730 hours onward: registration and evening meal.
Friday, 15 May	Daytime: presentation at a venue in Crewe.
Friday, 15 May	Evening: banquet or similar event.
Saturday, 16 May:	Field visit to river, coastal and mineral extraction sites in Cheshire/Merseyside.
Sunday, 17 May:	Field visit to upland locations, Peak National Park.

The conference will end at 1630 hours in time for connecting trains.

## Costs

Costs are shown on the registration form. The conference will be run on a non-profit making basis. The organisers reserve the right to pass on price adjustments of up to 10% in these costs in the event that increases beyond their control occur, and their liability is limited to refund of the deposit in the event that unforeseen cancellation of the conference occurs. However, as sponsorship is being sought, costs of registration and field visits may be reduced.

## If you wish to attend

Please fill in the registration form and send the deposit by the end of November, 1991 to me at the address below. The balance will be payable by 1st April 1992. Please also fill in the 'papers and presentations' form if you wish to submit a paper and return it by end of November, also. We will be delighted to supply further information if required; please telephone Jo Collinge on 0733-340345 extension 2322 (direct line 0733-318322).

Chris Stevens

Meetings Secretary

Geological Society Conservation Committee

Nature Conservancy Council for England

Northminster House

Peterborough, PE1 1UA

**Joint Meeting of the *Quaternary Research Association* and the  
*Tectonic Studies Group* with the *INQUA Neotectonics*  
*Commission***

**CALL FOR PAPERS**

Two-day conference on

**NEOTECTONICS**

To be held at the Geological Society Apartments, Burlington House, Piccadilly,  
London

**16th and 17th June, 1992**

Papers and/or posters are invited on a wide range of interests related to the study of neotectonics. Sessions will cover such topics as tectonic geomorphology, neotectonic mapping, seismotectonics, palaeoseismicity, intra-plate geodynamics, remote sensing and neotectonics, applications and hazards, sea level and coastal stability, and isostatic processes.

It is hoped to produce a Geological Society Special Publication of accepted papers.

Please send a title and abstract of your contribution (less than 300 words) to one of the convenors by **1st November 1991**.

Further information can be obtained from any one of the convenors:

**Dr Lewis A. Owen**, Departments of Geography and Geology, Royal Holloway and Bedford New College, University of London, Egham, Surrey TX20 0EX  
(Tel: 0784-443570; Fax 0784-72836)

**Dr Iain Stewart**, Department of Geography and Geology, West London Institute, Lancaster House, Borough Road, Isleworth, Middlesex TW7 5DU  
(Tel: 081-5688741 ext. 2835; Fax 081-5699198)

**Professor Claudio Vita-Finzi**, Department of Geology, University College London, Gower Street, London WC1E 6BT

**Professor Nils-Axel Morner**, Paleogeophysics and Geodynamics, University of Stockholm, S-106 91 Stockholm, Sweden (Fax Int +46 8 345808)

## QRA DISCUSSION MEETING, JANUARY 1992

Convenors: Drs D D Gilbertson and P A Smithson  
Departments of Archaeology and Prehistory and Geography  
University of Sheffield

Topic: 'Recent themes in Quaternary Research'

Location: Marshall Hall, Sheffield City Polytechnic

Programme of lectures: time allocation includes 10 minutes for discussions.

### Friday 3rd January 1992

2.00–2.40 p.m. K E Barber, F M Chambers and D Maddy *Late Holocene palaeoclimates from plant macrofossil assemblages and humification changes in ombrotrophic peat bogs.*

2.40–3.20 p.m. C D R Evans and C James *Some aspects of the Quaternary history of Hong Kong's territorial waters.*

3.20–3.50 p.m. Tea and coffee break.

3.50–4.30 p.m. K V Boyle *Zoogeography: spatial patterning in the faunal record.*

4.30–5.10 p.m. N R J Fieller and J A Padmore *Advances in Correspondence Analysis for palaeoecological research.*

END.

### Saturday 4th January 1992

9.30–10.30 a.m. Invited Lecture. R W Dennell *In search of Eurasia's oldest hominids.*

10.30–11.00 a.m. Tea and coffee break.

11.00–11.40 a.m. D Q Bowen *Aminostratigraphy of the British Isles and its correlation: testing the hypothesis.*

11.40–12.20 p.m. D Maddy, D Q Bowen, D H Keen, C P Green and S G Lewis *The English West Midlands: a type area for the British Upper Middle Pleistocene.*

12.20–1.00 p.m. M J C Walker, J W Merritt, C Auton, G R Coope, M Field, H Heijnis and B J Taylor *Allt Odhar: an early Devensian interstadial site in northern Scotland.*

1.00–2.40 p.m. R Coard *Taphonomic studies of still-articulated vertebrate remains in streams.*

2.40–3.20 p.m. P A Smithson *The microclimatology of modern and Quaternary caves.*



3.20-4.00 p.m. G M Coles and D D Gilbertson *The taphonomy of airfall-pollen in caves.*

4.00 p.m. Tea, coffee and depart.

## ABSTRACTS OF PAPERS

### *Late Holocene palaeoclimates from plant macrofossil assemblages and humification changes in ombrotrophic peat bogs*

*K E Barber, F M Chambers and D Maddy*

This paper will present a progress report on the NERC Palaeoclimate of the Last Glacial/Interglacial Special Topic funded research on the spatial and temporal variability of Late Holocene palaeoclimates derived from peat stratigraphy.

The project is attempting to move from a qualitative assessment of climate derived from the proxy data afforded by macrofossils and humification, to a more rigorous quantified assessment which may then lend itself to a modelling approach. The theoretical and practical problems will be outlined and early results from Bolton Fell Moss, Cumbria, aimed at establishing a transfer function, will be presented.

### *Some aspects of the Quaternary history of Hong Kong's territorial waters*

*C D R Evans and C James, British Geological Survey, Keyworth, Nottingham*

Extensive drilling and seismic profiling of Hong Kong's territorial waters, situated at the mouth of the Pearl River, have led to a better understanding of the Quaternary stratigraphy of the area. The sequence is divided into a lower, lithologically variable alluvial unit and an overlying dominantly marine unit. Both units thicken seawards. The former has a maximum thickness of about 50 m thick and is poorly dated; the latter has a similar maximum thickness and is divisible into at least two transgressive sequences probably of Pleistocene and Holocene age, respectively. The marine sequences rest on a locally channelled, generally planar, erosion surface. Their basal sections are made up of a range of facies which vary both laterally and vertically but the sequences are predominantly tabular mud bodies which vary in geometry in accord with changes in the local tidal regime.

The variability of the Quaternary sequences of the area shows the need to integrate available seismic data with drilling information before attempting to establish a stratigraphy for such an area.

### *Zoogeography — spatial patterning in the Quaternary faunal record*

*K V Boyle*

Research has shown that regional spatial patterning may be discerned in the distribution of animal species — in the modern, historic and prehistoric world. Such patterning can be observed for both large and small taxa, vertebrates and invertebrates etc. Biogeographical studies have shown us that regularities in the community structure of any species may be identified over time and space. Recurrent patterns are not random. Few species are truly ubiquitous. Instead, regularities occur which may be explained in a number of ways, based primarily on the assumption that taxa occur where conditions necessary for their survival and, more importantly, reproduction, prevail. Such is the case in South West France and the Mendips (Somerset) — areas in which the palaeolithic faunal database is sufficiently rich to enable the archaeozoologist to draw conclusions concerning both the structure of the prevalent environment and the human exploitation thereof.

### *Advances in Correspondence Analysis for palaeoecological research*

*N R J Fieller and J Padmore*

Department of Probability and Statistics, University of Sheffield

This paper describes recent advances in the theoretical basis and application of Correspondence Analysis — a statistical procedure which is remarkably well suited to addressing problems in palaeoecology. The paper describes these advances with reference to two recent case studies: vertebrate assemblages in cave sediments, and phytoliths in midden deposits.

### *In search of Eurasia's oldest hominids*

*R W Dennell*, University of Sheffield

Although East Africa has been the classic study area for early hominids in recent decades, the presence of early hominids in Asia has long been suspected. Over the past decade, extensive and intensive studies in the early Pleistocene alluvial fan and fluvial sequences in the Pabbi Hills of Pakistan have relocated the rich vertebrate faunas of Early Quaternary age described in the 1920's, and established the presence of in situ human artefacts. Attention now focuses upon the period from 1.5 to 2 million years ago.

### *Aminostratigraphy of the Bristol Isles and its correlations: testing the hypothesis*

*D Q Bowen*, University College of Wales, Aberystwyth

The time-dependent epimerization of isoleucine in marine and non-marine

fossil bivalves and gastropods has enabled an aminostratigraphic time-scale to be proposed.

When tested against regional lithostratigraphy, the events the hypothesis postulates are confirmed.

The aminostratigraphic framework thus comprises a significant contribution towards the formulation of a revised standard chronostratigraphy.

### *The English West Midlands: A type area for the British Upper Middle Pleistocene*

*D Maddy, D Q Bowen, D H Keen, C P Green and S G Lewis*

This paper will discuss the recent controversy concerning the status of the Wolstonian glaciation. Although amino acid racemization, faunas and the geomorphology of both pre-till and post-till deposits suggest that the glacial deposits at Wolston are older than previously thought (Rose, 1987; Maddy, 1989; Bowen et al., 1989, Maddy et al., 1991), evidence will be presented to demonstrate that the West Midlands area contains a sequence of both fluvial and glacial sediments which were deposited during the time period conventionally referred to as the 'Wolstonian' Stage.

The new stratigraphic interpretation displays a more complex sequence of cold-temperate successions than was previously postulated for this time period, and invites the correlation of this sequence with the climatic fluctuations recorded in the deep ocean cores. A case will be presented for the adoption of the oceanic stage nomenclature for this sequence.

### *Allt Odhar: an early Devensian Interstadial site in Northern Scotland*

*M J Walker (Lampeter), J W Merritt, C A Auton (BGS, Edinburgh),  
G R Coope (Birmingham), M Field (Cambridge), H Heinis (Groningen)  
and B J Taylor (BGS, Nottingham)*

This paper describes the lithostratigraphy and biostratigraphy of a section exposed in a river cliff of the Allt Odhar some 16 km south-east of Inverness, Scotland. A felled peat, which outcrops beneath Devensian tills, has yielded pollen, plant macrofossil and coleopteran remains. The palaeobotanical record shows an episode of birch woodland expansion and its eventual replacement by open grassland. A climatic regime slightly cooler than that of today is implied. U-series disequilibrium dating of the peats produced an age of c.106 ka BP. The evidence suggests that Allt Odhar may be the correlative of the Chelford Interstadial of lowland England, the Brorup Interstadial of continental Europe and Isotope Substage 5c of the deep-ocean record.

### *Taphonomic studies of still-articulated vertebrate remains in streams*

R Coard, University of Sheffield

The remains of Pleistocene vertebrates are commonly recovered from fluvial deposits. Much of the experimental research that provides the taphonomic underpinning of our understanding of the origins of such fossil assemblages in fluvial deposits is based upon observations of the behaviour of individual bones in flume or field studies. In practice, terrestrial vertebrate remains are often still-articulated when they enter the fluvial systems. This paper describes and discusses flume studies of still-articulated vertebrates and comments on the implications of this research.

### *The microclimatology of modern and Quaternary caves*

P A Smithson, Department of Geography, University of Sheffield

Investigations into the thermal regime of a cave in the Peak District of Derbyshire show a strong seasonal variation. In summer the main chamber of the cave has an almost uniform temperature with a slight increase with height above the cave floor. Its value of 7°C is close to the mean annual temperature recorded at a standard climatological station nearby. Whenever the outside temperature falls below about 7°C, density currents slowly flow into the cave, bringing cooler temperatures into the lowest part of the cave. Winds blowing directly into the cave also affect the temperature regime through forcing external air into the cave system. The implications of these airflows for pollen and spore movement will be discussed. The nature of the links between outside and interior temperatures are investigated by correlation analysis.

### *The taphonomy of airfall-pollen in caves*

G M Coles and D D Gilbertson

University of Edinburgh and University of Sheffield

This paper describes the results of pollen-taphonomic studies of the airfall-pollen in three caves of different form and size at Creswell Crags. The effects of changes in distance from cave mouth, time-of-year, cave entrance vegetation and cave microclimatology are discussed; with the general conclusion being reached that the modern airfall-pollen in these caves reflects the vegetation in the cave entrance and the vegetation within a 5 km radius of the cave.

Please find registration form at the back of this Newsletter

## PARAGLACIAL FANS OR SOLIFLUCTION SHEETS?

A reply to Dr Stephen Harrison

The solifluction sheets of mid-Wales have very little in common with paraglacial alluvial fans as described by Dr S Harrison (QN No. 64), neither in fabric nor in structure. Further, they have not the geometry of fluvial fans. There is a superficial resemblance in morphology but whereas the surface of "paraglacial fans" is "nectilinear", solifluction sheets are concave, falling gently from  $>30^\circ$  to  $<2^\circ$ .

There is a very close parallel in all ways between Welsh solifluction sheets and the head or slope deposits of the Ardennes, the Cotentin Peninsula in Normandy and the south coast of England as recorded by Prestwich more than a century ago, in fabric, pseudo bedding, the lenticular nature of the interbedded washed sediments, the decreasing dip angles as the material is built up and the character of the clasts. The fabric pattern of the clasts in head is unmistakable. Not only is the long axis aligned down-slope but, the dip of the 'a' axis is subparallel and slightly imbricate to the pseudo bedding. The narrow spread of dip angles is also striking. Any sediment existing on the slope, e.g. till, river or beach gravels, loess etc. is of course entrained in the head as it forms.

It is not correct that till units are included in the mid-Wales head. Till has certainly been present at one time and has been seen in sites protected from erosion, under Bronglais Hospital in Aberystwyth, also further south down the coast on the shore platform, and in the bed of a small stream at c.500 m under Plynlimon. In general the head rests on rock. During the construction of the Nant-y-Moch hydroelectric scheme, three dams were excavated to bedrock in the Rheidol valley, the highest at 335 m. Here a possible till was seen between two rock ridges at the lowest point of the dam but clasts were not glacially worn; striae were confined to mudstones. Otherwise cold river gravels form the basal valley fill with interfingered head on the valley sides.

Some thirty years ago Professor Alan Wood considered that the mid-Wales solifluction sheets consisted of till whose surface had been smoothed by solifluction. Exposures in the river valleys are limited in extent but the head cliffs on the coast, studied in detail at Morfa-Bychan, 5 km south of Aberystwyth, give continuous strike-exposures for more than 3 km. The head cliffs exceed 49 m at the highest point. Numerous active gullies give excellent dip sections. The sequence of events at Morfa Bychan is as follows: a degraded rock cliff has collapsed in large slipped blocks up to 13 m in length, buried in weathered rock debris (the Yellow head) lying at angles of  $>30^\circ$  at the beach. The base of the ancient rock cliff and head is below present sea level. This is conformably overlain by the "Blue" head, fresh and unweathered but with much the same clay content (c.20%). The dip angle of the washed lenses decreases steadily upwards. In the upper part of the cliff there seems to have been a break in deposition and hollows in the surface of the Blue head have been infilled with slopewash beds varying from coarse lag detritus to rounded fine gravel, clean sand and lenses of silt. Slump features of sand balls in silt and angular silt

fragments in sand were noted. Head deposition then resumed. Some 6 m below the cliff top large blocks of bedrock occur still retaining the original interbedded mudstone/grit character. The "Brown" head cuts across all earlier deposits at a much lower angle of pseudo bedding. The rock fragments are unweathered but the matrix has much less clay with a large percentage (20-25%) of coarse sand. Dip angles drop to  $<2^\circ$ . Solifluction ceased and deep contraction cracks formed (2-4 m) and were filled by aeolian "dust loam". This is about 1 m thick overlying all deposits. Of glacial deposits in situ there is no sign. Throughout the cliff, silt lenses contain spores of mosses and abraded plant tissue.

Clasts are typically "head" in character. Glacially abraded clasts are very rare; striae are found only on soft rocks. Clasts may be freshly shattered rock, edgeworn, subangular to rounded according to their previous history. These "worked" pebbles are often "split". A very informative example of reworking by solifluction was noted at Flamanville, W Cotentin Peninsular. A raised beach was seen at the base of a high head cliff. The well-rounded flint gravels had a (typical beach fabric, 'b') axis imbricate to the waves. The gravels had later been entrained in the base of the overlying head, 'a' axis downslope and imbricate to the pseudo bedding. Many of the clasts had been split, presenting a sharp new fracture, the remainder of the pebble having been deposited elsewhere. This is typical of head and has been observed frequently in the solifluction sheets in Wales.

The slow rate of deposition by solifluction makes a Late Glacial age for the transformation of glacial deposits into solifluction sheets quite untenable. The interpretation as "paraglacial fans" may be quite acceptable in recently glaciated areas such as the Cheviot Hills but it certainly does not explain the origin of the drifts of mid-Wales.

## REFERENCES

- Alexandre, J. 1958 Le modelé quaternaire de l'Ardenne Central. *Ann. Soc. Géol. Belg.*, 81, 213-331.
- Edward Watson. 1967. Unpublished PhD thesis:- The periglacial element in the landscape of the Aberystwyth region. Un. Wales Aberystwyth.
- Edward and Sybil Watson. 1967. The periglacial origin of the drifts at Morfa-bychan, near Aberystwyth. *Geol. Journ.*, Vol. 5, 419-440.
- — 1970. The coastal periglacial slope deposits of the Cotentin Peninsula. *IBG Trans.*, No. 49, 125-144.

Mrs Sybil Watson, MA  
83 Rawbrae Road,  
Whitehead  
Carrickfergus  
Co. Antrim  
N. Ireland  
BT38 9SX

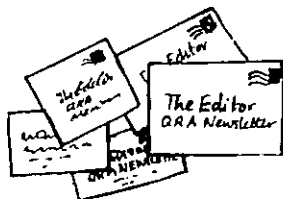
## INQUA OFFICERS

Below is a list of the newly elected INQUA officers:

PRESIDENT:	Lui Tungshens — China
VICE PRESIDENT:	Horst H K Kagedorn — Germany Jim Bowler — Australia A A Velichko — USSR/Russia Steve Porter — USA
SECRETARY GENERAL:	Edward Derbyshire — UK
TREASURER:	Eduardo F J D E Mulder — Netherlands



# POST BAG



Dear Dr Taylor,

assuming that no reader has drawn your attention to the attached howler, I do so now. It caused much leg pulling here!

sincerely  
Edward Derbyshire

## LOESS-PALAEOSOL SEQUENCES AS RECORDERS OF PALAEOCLIMATIC VARIATION IN CENTRAL CHINA — a collaborative NERC-funded project

The Natural Environment Research Council (NERC) have agreed to fund this project under the 'Palaeoclimate of the last glacial/interglacial cycle' Special Topic. It will be coordinated from the Centre for Loess Research and Documentation at the University of Leicester by Professor Edward Derbyshire, with Dr John Shaw (Geomagnetism Laboratory, University of Liverpool) and Dr Ann Winstle (Earth Studies, University College, Wales) as the other principal investigators. Drs D Kren (Geography, Coventry Polytechnic), R Kemp (Geography, RHBC, University of London), T Ralph and A Lamb (both Geomagnetism Laboratory, Liverpool University) from Europe and Professor An Zhaoheng (Xian Loess Laboratory) and Wang Jinjin (Lanzhou Geological Hazards Laboratory) from China, are associated investigators. The project will sustain two full-time post-doctoral research assistants (one each at Leicester and Liverpool) and one full-time post-graduate research assistant (at Aberystwyth).

The project aims to determine past variations in wind direction and strength and the relative importance of deserts and glaciers as loess sources in a region of severe climatic gradients between the Loess Plateau and the Qianghai Xizang (Tibet) Plateau. It involves close collaboration with the Xian Laboratory for Loess Research and Documentation (Chinese Academy of Sciences) and the Lanzhou Geological Hazards Institute (Gansu Province Academy of Sciences). Other aims include the establishment of a typology for the palaeosols as a measure of climatic shift, determination of the pedogenic and aeolian flux components of the magnetic susceptibility, and the dating of key sections in this, the thickest known loess on earth (> 300 m). These data will be used to construct a climatic curve to compare with the oxygen isotope record and calculated astronomical parameters and to assess any phase lag in the response of magnetic susceptibility to shifts in the climatic zones. Coarse-grained sampling will be undertaken at two key sites and data used from a third site, all sites lying along an altitudinal and climatic gradient. Quaternary fabric analysis will be used to assess the effect of variations in wind regime and the effect of erosion and reworking on the chronometric record. Environmental data will also be derived from soil typology, using micromorphology, and the molluscan fauna. Direct dating will be achieved by a combination of luminescence, U-series, alpha-spectrometry and magnetic susceptibility. Magnetometry will be used to test for contemporaneous climatic changes at different altitudes across central north China.

Professor Edward Derbyshire  
The University of Leicester  
Loess Research and Documentation Centre  
Leicester LE1 7RH

## MEMBERSHIP PLEASE NOTE: GRANTS AND CORRESPONDENTS

I have been asked by C R Argent of The Royal Society to draw the attention of the membership to two matters. Firstly, in the newsletter (via Miss B M deVere) of grants from the X INQUA Congress Fund for the XIII INQUA Congress in Beijing. Secondly, there is the matter of Quaternary-focused IGC projects and those UK correspondents for projects in which the UK is participating formally. Taking the list on p 30 of Newsletter No. 62, the correspondents for those projects continuing beyond 1990 are:

252	Professor E Derbyshire	(Geology, Keele)
253	Dr J J Lowe	(Geography, Royal Holloway and Bedford New College, London)
274	Dr I Shenan	(Geography, Durham)
296	Dr J Shaw	(Geology, Liverpool)

## EARTH SCIENCE CONSERVATION IN GREAT BRITAIN — A STRATEGY

In December the Nature Conservancy Council launched a wide-ranging strategy document for conservation of earth science sites in Britain over the next five years. It aims to promote the widest possible participation and includes six principal outcomes:

- 1 maintaining the SSSI network
- 2 expanding the network of Regionally Important Geological and Geomorphological Sites (RIGGS)
- 3 developing new conservation techniques
- 4 improving site documentation
- 5 increasing public awareness
- 6 developing international links.

Copies of the strategy document are available free from the Earth Science Division, Nature Conservancy Council, Northminster House, Peterborough PE1 1UA.

Dear Dr Taylor

Just a quick note to inform you of a small but quite important typing error in my report on the Isle of Skye field trip in Quaternary Newsletter no.64. The title "Day 3 – pollen data, landslides are diatomite" should read "pollen data, landslides and diatomite"? The former version implies a somewhat remarkable geomorphic history and might lead some readers to the Isle of Skye on false pretences – poor souls!

From: David J A Evans  
Dept. of Geography and Topographic Science  
University of Glasgow

*Apologies to Edward Derbyshire and David Evans for the inadvertant errors in the last issue of the Newsletter. Their comments arrived just as I received a draft of a letter, reproduced below, the mistakes being attributed by the secretary to my virtually illegible handwriting.*

*Editor*

Professor Derek Blundell  
Geology Department  
Royal Holloway & Bedford New College  
Queens Building  
Egton Hill, Egton  
Surrey TW20 OEX

29 July 1991

Dear Derek

## EARTH SCIENCE EDUCATION FORUM

Thank you for your large bundle of directors which arrived intact but virtually devoid of any wrapping paper! I can also appreciate (for the first time, perhaps) Ray Adie's ardent belief in string and that off-repeated purchase 'Crieke, Taylor without string you lust!

My only addition to the original document related to page 76 and entry No.4 under 'Equipment Suppliers and Specimen Dealers. Stuart A Baldwin (see attached letter) has supplied you with an amended entry which he (and I) hope will be incorporated in any new additions.

Kind regards  
Yours sincerely

Dr B Taylor  
Corpulant Marketing Manager

## NOTES

9

**QRA ANNUAL DISCUSSION MEETING**

**SHEFFIELD CITY POLYTECHNIC  
3-4TH JANUARY 1992**

**'RECENT THEMES IN QUATERNARY RESEARCH'**

**REGISTRATION FORM**

Please tick as appropriate

Registration forms and fees to be sent  
by December 10th 1991 to:

Dr P A Smithson  
Department of Geography  
The University  
Sheffield S10 2TN  
[Telephone 0742 768555]

I wish to attend the QRA Annual Discussion Meeting  
on 'Recent themes for Quaternary Research'  
and enclose the Registration Fee of £15.00

☐

I wish to book meals and accommodation as follows:-

Bed & Breakfast, 3rd January @ £17.00

☐

Lunch, 3rd January @ £6.75

☐

Dinner, bed & breakfast, 3-4th Jan. @ £27.50

☐

Lunch, 4th January @ £6.75

☐

Bed & Breakfast, 5th January @ £17.00

☐

**Non-residents**

Beverages, on 3rd & 4th @ £2.25

☐

I enclose a deposit of 10% of total costs  
for meals and accommodation

☐ Deposit amount £.....

All prices are inclusive of VAT

Cheques should be made payable to P A Smithson (QRA A/C)

Accommodation is in Marshall Hall, Collegiate Crescent adjacent to the Conference.

Single rooms with wash basin.

Any special dietary requirements (please specify).....

From: .....

Address: .....

Telephone: .....

Signature: .....

**QRA ANNUAL DISCUSSION MEETING**

**SHEFFIELD CITY POLYTECHNIC**

**3-4TH JANUARY 1991**

**'RECENT THEMES IN QUATERNARY RESEARCH'**

**MEMO**

To be retained

I have paid my £15.00 Registrarian Fee for the above meeting

☐

I have asked for the following meals and accommodation:

Bed & Breakfast, 3rd January @ £17.00

☐

Lunch, 3rd January @ £6.75

☐

Dinner, bed & breakfast, 3-4th Jan. @ £27.50

☐

Lunch, 4th January @ £6.75

☐

Bed & Breakfast, 5th January @ £17.00

☐

**Non-residents**

Beverages, on 3rd & 4th @ £2.25

☐

Total costs for meals and accommodation

£ .....

10% of total costs for meals and accommodation

£ .....

I have paid my deposit for meals and accommodation

☐

Date .....

## 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. Most members reside in Great Britain, but membership also extends to most European countries, North America, Africa and Australasia. Current membership stands at c.1000. Membership is open to all interested in the objectives of the Association. The annual subscription for ordinary members is £10.00 and is due on January 1st for each calendar year. Reduced rates apply for students, unwaged and associated members.

The main meetings of the Association are the Annual Field Meeting, usually lasting 3 or 4 days, held in April, and a 1 or 2 day Discussion Meeting held at the beginning of January. Additionally, Short Field Meetings may be held in May or September and occasionally these visit overseas locations. Study Courses on the 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 November, the *Journal of Quaternary Science* published in association with Wileys, and with three issues a year, 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 course of the April field meeting. The current officers of the Association are:

President: Professor G S Boulton, Department of Geology and Geophysics, University of Edinburgh, James Clerk Maxwell Building, Mayfield Road, Edinburgh EH9 3JZ

Vice President Professor W A Watts, Provost's House, Trinity College, Dublin 2, Ireland

Secretary Dr M J C Walker, St David's University College, Lampeter, Dyfed, Wales SA48 7ED

Assistant Secretary (Publications): Dr D R Bridgland, 41 Geneva Road, Darlington, Co Durham DL1 4NE

Treasurer: C A Whiteman, Botany School, University of Cambridge, Downing Street, Cambridge CB2 3EA

Editor (*Quaternary Newsletter*): Dr B J Taylor, British Geological Survey, Keyworth, Nottingham NG12 5GG

Editor (*Journal of Quaternary Science*): Dr P L Gibbard, Botany School, University of Cambridge, Downing Street, Cambridge CB2 2EA

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.

# QUATERNARY NEWSLETTER

## QN:

October 1991 No. 65

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