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# IQUA

**Cumann Staidéar Ré Cheathartha na h-Éireann**

**Irish Association for Quaternary Studies**

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**October 1997      NS 19**  
**ISSN 0790-4096**

**Editor: Karen Molloy**

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## **Introduction**

This lengthy issue of the Newsletter contains accounts of the most recent activities of IQUA members and also introduces new members from overseas and from Ireland. The opening item is a report on the Annual Field Meeting which this year was based in the midlands. Many aspects of the Quaternary environment including archaeology, geomorphology and palaeoecology were discussed during the course of the weekend and those of us who couldn't make it appear to have missed out on a great weekend.

The next IQUA event is, of course, the Annual Symposium which will take place in November. Further information on the Symposium, which should be of interest to a wide audience, is given in this Newsletter.

Also included in this Newsletter is an account of an ESF conference attended by several IQUA members, a research report from the GSI and an abstract of a recently completed PhD thesis.

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## **IQUA Annual Field Meeting:**

### **The Irish Midlands, 4th-5th October, 1997**

The excursion, organised by Fraser Mitchell and Cathy Delaney, provided us with the opportunity to visit some past and present wetland landscapes and to look at the systems that created them and now sustain them. The IQUA Field guide No 21, edited by the organisers, provides an introduction to the bedrock and Quaternary geology, palaeoecology and archaeology of the region and detailed information on the sites visited.

On the morning of the first day the group (of about 25) assembled at the Fairgreen in Clara and set off in convoy for the short drive to Clara esker on the northern side of the bog. Here Mary Smyth presented some of the results of her research into Quaternary geology and geophysics carried out as part of the Joint Irish-Dutch Clara Bog Project. She described the esker complex which ranges from 100-1500m in width, and includes many classic

attributes such as kettle holes and hill and ridge features.

We next moved on to Clara Bog where depth sections of the bog, resulting from mapping, probing, drilling and geophysical surveying, were presented and discussed. Andrew Connolly contributed his work on vegetation and bog development. He also pointed out the main topographical features which include the soak systems which give rise to an unusual flora due to a higher than normal availability of nutrients. After viewing (and for some experiencing) the watery excesses of a soak we squelched our way back to Clara for lunch.

In the afternoon we visited a number of sites of earlier human activity which involved the development of somewhat safer means of traversing bogs. Conor McDermott and Ellen O'Carroll led us on a tour of two of the many wetland sites in the area which have been investigated by the Wetlands Unit in UCD. Ellen safely guided us to Derrynagun Bog, Lemanaghan Works, in which there is evidence of activity from the mid second millennium BC, and where an excavation cutting had exposed a trackway sequence which resulted from five phases of activity spanning 600 years beginning at AD 653±9. From the sturdy oak timbers of Derrynagun, Conor next took us to sites of rather more enigmatic origins and function at Curraghalassa Bog. Here in the drain faces were exposed small deposits of worked wood, toghers and a very fragile trace of a hurdle.

We next visited the 'invisible' evidence of an early crossing site of the River Shannon near the monastic site at Clonmacnoise. Donal Boland

recounted the painstaking diver surveys of the riverbed that have finally confirmed the existence and location of a long-sought-for crossing point. The site consists of the submerged remnant posts and timbers of a substantial Early Medieval wooden bridge which has been dated by dendrochronology to AD 804. Down by the Shannon side, with the aid of copious drawings and sketches, Donal convinced the audience that they were in fact standing close to the landfall of the invisible bridge. To enhance the vivid image previously painted of the bridge Kevin Barton produced some fuzzy ground penetrating radar images of timbers obtained during a waterborne geophysical survey of the crossing site. The survey also identified a large number of river/sub-river bed targets which could be due to geological or archaeological sources.

As the light was fading the archaeological baton was passed to Con Manning who guided us on a tour of the unique monastic site of Clonmacnoise. We viewed and debated the richly decorated panels of the high crosses and sparse legends of the cross slabs and finally the many architectural features of the church buildings. A date of around AD 800 has been proposed for the North Cross which would make it contemporary with the wooden bridge although the site itself could possibly be much older.

After a rainy night in Mullingar we regrouped for further watery delights in the form of a brief look at the landforms and hydrology of the area. David Drew led this part of the excursion and took us to Fore where he showed us visible evidence of karst processes. The extent and timing of karstification in the central lowlands

was discussed. The view advanced being that the area could be interpreted as a palaeokarst with the onset of karstification being in Tertiary times. From our vantage point in Fore we could also see evidence of more recent fluvio-glacial influences on the landscape. Here we also noted springs and sinks which are manifestations of the complex hydrogeology of the area. This point was demonstrated at the next locality at Lough Lene where we saw some outflow channels which rapidly flowed underground through sinkholes and whose waters feed springs at Fore. The lake itself has no surface inflow. The inferences presently drawn from this landscape are that the shallow underground drainage may be related to present day active and probably postglacial karstic drainage whilst a more ancient karstic landscape may be evidenced by large springs, stable flows, large residence times and possible reuse of fossil conduit systems.

We continued with a recurring theme of the weekend, wetlands and human interactions and a visit to the Corlea Trackway where Conor McDermott had arranged a special opening of the Visitor Centre. The long and painstaking work in excavating and conserving the wooden trackway in the bog was discussed. After a tour of the Visitor Centre we gathered around the conserved trackway for a question and answer session on its provenance and usage.

The final locality visited was a section of the Ballymahon esker where Cathy Delaney presented an account of the formation and features of this sinuous feature which extends for some 10 km in a NW-SE direction. The esker consists of a series of tunnel-to-ice-margin

segments with the youngest being in the northwest. The locality visited, Carrickagower Borrow Pit, exhibited many classic and intriguing esker features which taxed the group as to their origins and development.

The excursion finished in the late afternoon with Mike Philcox thanking the organisers and leaders on behalf of the group for an extremely well organised and stimulating weekend which further demonstrated the value of IQUA in providing a platform for the integrated study of the Irish Quaternary.

**Kevin Barton, Applied Geophysics Unit,  
NUI, Galway**

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## **IQUA Annual Symposium 1996**

The forthcoming IQUA Annual Symposium is being organised by George Dardis and is entitled **Problems, Approaches and Issues in the Irish Quaternary**. It will be held at the Geological Survey of Ireland, Haddington Road, Dublin 4, on Friday, 21st November, 1997. Lectures begin at 10.00 am.

A provisional programme has been established along four themes:

- (1) Quaternary timescales (speakers Prof. Mike Baillie, Prof. Jon Pilcher)
- (2) Multidisciplinary Quaternary projects (A series of short reports on the progress of the Lough Neagh palaeoenvironments project - this is a synopsis of the work of this group, convened by Dr. Suzanne Leroy)
- (3) Quaternary databases (speakers Dr. Valerie Hall, Stephen McCarron, plus 1/2 others)



(4) Quaternary processes, sediments and landforms (speakers Drs Jasper Knight, George Dardis, Peter Wilson, Philippe MacClenahan)

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## Research Report

### Quaternary Geology Mapping and Groundwater Protection Schemes

For several years now the Geological Survey of Ireland (GSI) has been involved with a number of County Councils in drawing up Groundwater Protection Schemes for their areas. The work has been undertaken by the Quaternary and Groundwater Sections of the GSI. This work is largely funded by the Councils with the GSI giving considerable logistical support as well as supervision of the staff employed. The duration of the projects are normally 2 to 3 years depending on the size of the county. To date schemes have been completed for Counties Limerick, Waterford, Offaly and Tipperary South Riding. In these early projects the Quaternary input was limited to a supervisory role in data compilation and assessment. In the current phase of projects - Meath, Clare, Laois, Wicklow, and most recently Kilkenny - that input has expanded enormously. The projects are composed of two main components.

Firstly, the Quaternary Geology of the complete county is mapped at a scale of 1:25,000. The Quaternary sediments and their thickness are critical in the assessment of groundwater vulnerability. This is done under a Studentship system whereby a student, registered for a postgraduate qualification, undertakes the mapping programme. To date these students

have been attached to the Department of Physical Geography and Soil Science at the University of Amsterdam and to the Department of Geography at UCD. Initial registration is usually for a Masters programme with the option to extend to a Doctoral thesis in certain circumstances.

The work initially involves the compilation of all available Quaternary data for the county. This includes geological and depth to bedrock information from a variety of sources including: GSI maps; air photos; other published and unpublished sources; the geotechnical, well and minerals openfile databases of GSI. The engineering offices of the councils can also provide useful data. This is all compiled on 1:25000 maps and digitised into Autocad. Field mapping involves the delineation of the main sediment types viz. glacial till, sands and gravels, head, alluvium, peat, lake clays as well as rock near surface. The main morphological features are also mapped as are indicators of ice direction. In addition trenching and drilling are undertaken to obtain further information in areas of poor exposure. Petrographic stone counts and grain size analyses are done on the extensive bulk sample collections. Contouring of depth to bedrock is done where the density of data points is adequate. The final product is a county map at a scale of approx. 1:50,000 and a report which includes detailed descriptions for each 1:25,000 map area. This work will then be used in the production of the new GSI 1:50,000 Quaternary Geology map series.

Secondly comes the hydrogeological data collection and the construction of the protection scheme itself. The schemes have three main

objectives. These are to assist the local authorities in protecting and conserving groundwater resources, to provide geological/hydrogeological data valuable in the planning process, and to focus on high risk areas and activities. The hydrogeological work is undertaken by a contract hydrogeologist. As with the Quaternary work the first stage is database compilation of all hydrogeological (eg. wells, springs, karst features) and water quality data held in GSI and in the county council. The outputs from this work are a hydrogeological data map, a groundwater vulnerability map, an aquifer map and a groundwater resource protection map. These are regional maps on a scale of 1:63,360 or 1:50,000. In addition there are groundwater source protection maps at a scale of 1:10,560. These maps are also produced digitally in Autocad so that they can be readily updated.

A key element is the groundwater vulnerability mapping which depends heavily on the Quaternary mapping as the type, permeability and thickness is critical in assessing the sensitivity of groundwater to pollution. Full chemical analyses of sources is undertaken. Special Protection Areas (SPAs) around a number of major sources are subject to detailed investigation including numerical modelling where appropriate. Resource protection zones are delineated by combining aquifer and vulnerability maps, potentially producing 24 levels of zonation.

These schemes provide valuable information to local authorities for the protection and conservation of their groundwater resources. This geoscience data however has a much wider

application for councils. This would include locating groundwater sources, locating aggregate supplies, providing data on ground conditions for road building and other infrastructural developments, as well as educational and tourism applications. These cooperative ventures between the GSI and county councils have been very successful and provide valuable data to both.

**Ronnie Creighton, Quaternary and Geotechnical section, GSI**

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## **Report on the ESF funded Conference**

### **THE ECOLOGICAL SETTING OF EUROPE: FROM THE PAST TO THE FUTURE**

#### **The Impact of Humans on the Environment of Europe since the end of the Ice Age**

*20-25 September 1997, Castelvecchio Pascoli, Italy*

This meeting which was held in northern Tuscany was attended by 85 participants. It was the third of a series of research conferences, on *The ecological setting of Europe: from the past to the future*. The theme of this meeting was human impact on the environment of Europe since the end of the last glaciation.

Burkhard Frenzel, who is the main administrator behind this succession of conferences, began the proceedings with an introductory talk on the history and aims of the series. A main focus of his lecture was deciding on how ecological settings should proceed and the reliability of past

prognoses for the planning of the future. Peter Woodman (Archaeology Dept, NUI, Cork - Conference Chairman) then gave an informal talk on the layout of this particular conference. Communication was in the form of oral and poster presentations with oral presentations given by invited speakers only.

Following the opening session the first series of lectures focused on the identification of human activity from palynology. Bent Aaby lead the session with a talk on estimates of landscape openness in Northern Europe during the Holocene. This enlightening keynote lecture was followed by talks on studies in England (Kevin Edwards), Sweden (Bjorn Berglund), Russia (Olga Borisova) and the Mediterranean (Jose Eduardo Mateus).

Session 2 took place on the second day and centred around ecological degradation and change. This session was lead by a very impressive and informative talk by Frank Chambers who pondered on the problems associated with the evaluation of ecological degradation from palaeoecological studies. He also raised the problem with the identification of "degraded" ecosystems in the context of devising management plans to remedy this supposed "degradation" and restore the "climax" state ("degraded" ecosystems refers to those ecosystems which have unusually poor or unusually rich species diversity). This problem is particularly topical amongst a lot of national conservation organisations whose current concerns over biodiversity and sustainability necessitates them to identify such "degraded" systems.

This talk was followed by lectures on the degradation of heathland across Northern and Western Europe (Michael O'Connell); the impact of humans on recent river sedimentation in Eastern Europe (Pavel Havlicek); molluscan evidence for human impact in the Mediterranean (Frederic Magnin) and finally the use of magnetic analyses to detect periods of intense soil erosion in lake sediments which are ascribed to anthropogenic activity (Per Sandgren).

Session 3 dealt with the use of chronologies and their precision and accuracy. This session was led by a brief talk by Peter Woodman on archaeological chronologies and how they have been established on a largely historical framework which is now proving to be unreliable in the context of radiocarbon dating and other dating techniques. He reminded us of the "baggage" associated with all disciplines and called for both environmental scientists and archaeologists to be honest in the presentation of their data. This is of particular relevance when attempting to infer meaning in our own studies using information from other disciplines. Jan van der Plicht from the Centre for Isotope Research in the Netherlands followed with an excellent talk on the technique of "wiggle" matching to fix floating chronologies such as tree-ring data. He also showed some very recent data relating to a collaborative study between his lab and some Japanese colleagues using an impressive varve record which extends back continuously to the Eemian Interglacial.

Mike Baillie then gave an intriguing lecture on his theory as to the cause of the great Biblical flood according to absolute dendrochronological data. The alarming coincidences that occur



between historical, dendrochronological and pollen records, would indicate that some global catastrophic event or series of catastrophic events took place at approximately 2354 years BC. Mike Baillie voiced his belief that we were hit by a comet which led to a series of events which had a huge impact on both humans and ecological processes and he dared any archaeologist or palaeoecologist to prove him wrong! Bernd Zolitschka finished the session with a general lecture on varve chronologies and their contribution as a dating tool for palaeoecological data.

Session 4 was more of a hodgepodge of talks with the emphasis on archaeological case-studies. Martin Bell was the keynote speaker for this session and gave an excellent lecture on his own studies in the Severn Estuary in Wales which looked at the degree of human impact and grazing on coastal wetland areas. He also mentioned The Experimental Earthwork Project which is a long-term study (designed to run for 128 years) looking at changes to two earthworks in terms of physical weathering, changes to buried biological evidence and buried organic and inorganic materials. Martin Bell emphasised the need for experimentation in archaeology which he regards as an important part of investigations of past human impact.

Other talks in this session included one very detailed account of archaeobotanical and archaeozoological evidence of human impact on Neolithic environments in Switzerland (Stefain Jacomet & Jorg Schibler). This talk was probably one of the most impressive throughout the whole conference in terms of the wealth of data gathered as well as the extremely high

resolution and numbers of disciplines involved. There were also talks on the role of insects as potential indicators of human activity (Eva Panagiotakopulu) and a case study from Northern Germany on the impact of Iron production on wood consumption in the area (Walter Dörfler).

The final day was rounded off by Doug Price from Madison, Wisconsin with a summary of the four days and his own personal conclusions and thoughts. There was then a lengthy discussion session which allowed people to air both general views on human impact throughout the Holocene, and also to challenge particular theories and opinions presented by individual speakers.

The main conclusions drawn from this conference were that: (1) Studies need to be of a much higher temporal and spatial resolution for improved correlation between palaeoecological and archaeological chronologies; (2) The quantification of vegetation and soil development is essential for studies on biodiversity changes and forest disturbances; (3) We need to apply the concept of modern analogues of ecosystems in the cultural landscape; (4) There is a need for increased multidisciplinary approach to palaeoecological and archaeological studies and; (5) we need to abandon the "baggage" that we carry with each discipline *i.e.* we need to revise the way in which we interpret our data and be more objective in our approach. The word "baggage" was used repeatedly throughout the conference and referred to "the information which each discipline historically draws on, with the assumption that this information is based on

research carried out using well established criteria", (Peter Woodman, pers.comm.).

My opinions on the conference are, that on the whole, the majority of the oral presentations were of an extremely high standard including both delivery and content. The posters were outstanding, particularly as regards presentation. I felt the discussions were, as at the previous conference, still dominated by a few senior individuals even though the younger researchers were encouraged to and indeed made every effort to participate. A criticism I would have as regards the majority of speakers, in particular the members of the archaeological community, is in relation to the quoting of radiocarbon dates. Very often it wasn't clear as to whether dates were calibrated or uncalibrated. I would hope that in future this problem will be amended.

**Alyson Heery, Department of Botany, TCD**

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### **Abstract of Recently Completed PhD Thesis and References for MSc Theses in Quaternary Science**

**Glanville, C.** 1997. *The Quaternary Sedimentology and Last Deglaciation of Mid- and South- Kildare*. Unpublished PhD Thesis, National University of Ireland, Dublin.

This thesis presents a detailed examination of the sedimentology of Quaternary glacial deposits in the mid- and south-Kildare region. The sediments were described, identified and subsequently mapped under five main categories of deposit genesis: glaciolacustrine; glaciofluvial; till; alluvial; and peat. Where the Quaternary deposits overlying rock were less than 1m in

depth they were mapped as rock close to the surface. Each category was further subdivided based on grain size and petrographic differences. Following this broad mapping project a detailed study of the Curragh region was carried out. The sediments in each of 18 specific sites were sampled and the sedimentary facies were logged and analysed. The samples were analysed in terms of particle size and petrographic components. The fabric was examined in detail to provide depositional flow indicators where appropriate and to provide a basis for sediment identification. The distribution of erratic clasts identified from the samples mapped, from which glacial flow directions could be inferred.

The results of this study indicated that the deglacial landscape is dominated by glaciofluvial and glaciolacustrine deposits including subaqueous fan, delta, esker and glaciofluvial outwash sediments. These are frequently overlain by diamictos. In some situations strong petrographic and lithological similarities were identified between the stratified sand and gravel deposits and the overlying diamictos, suggesting the reworking of sediments from the source material. However, there are differences in the petrographical makeup of the diamictos. In the east the diamictos are dominated by chert clasts and Lower Palaeozoic slates and shales, in the west they are dominated by limestone clasts and in the north greater quantities of sandstone clasts occur within the limestone dominated sediments.

Depositional processes were inferred from the sedimentological analyses at each site and deglacial environments were interpreted for the region. The conclusions suggest that there was



more than one ice margin; the decay of which formed a lake. Into this, glaciolacustrine sediments were deposited and associated with them are glaciofluvial sediments. The spatial relationships between deglacial deposits within the interpreted depositional environment, indicates a retreat and separation of ice margins. It is likely that the margins were those of ice lobes that were linked as a single ice mass during full glaciation. The former ice margin positions are indicated by the location of proglacial ice contact sediments close to the Curragh. At a late stage ice margins re-advanced over the glaciolacustrine sediments reworking the surface gravels and disturbing the lower sediments by faulting and shearing.

The following are a list of recently completed MSc theses in the Applied Geophysics Unit, NUI, Galway. Interested parties should note that these are minor theses and are only available for reference purposes in the Applied Geophysics Unit and cannot be obtained in any other manner.

**Grant, F.** 1997. *The Application of ArchaeoGeophysical Techniques at Two Famine House Sites Near Strokestown, Co Roscommon*. MSc minor thesis, Applied Geophysics Unit, National University of Ireland, Galway, MSC 97/1, unpublished.

**O'Rourke, S.** 1997. *Archaeological Geophysical Surveys in the Monastic Enclosure, Mayo Abbey and on the Moated Site, Cloghannageeragh, County Mayo*. MSc minor thesis, Applied Geophysics Unit,

National University of Ireland, Galway, MSC 97/6, unpublished.

**Rooney, S.** 1997. *Archaeological Geophysics in Shallow Waters; An Experimental Ground Penetrating Radar Survey on the River Shannon Near Clonmacnoise, Co. Offaly*. MSc minor thesis, Applied Geophysics Unit, National University of Ireland, Galway, MSC 97/7, unpublished.

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## New Postgraduate Research

I have returned to university after working many years in the field of underwater technology and marine biology. I am now working towards a PhD at City University of New York in archaeology with the hope of specializing in Irish archaeology. I am very interested in the mesolithic, specifically early beginnings of subsistence on marine mammals.

What I would like to do is to combine my background in marine technology, specifically the use of underwater robotics and other such technologies, with my training in archaeology (both dry and wet) to work on inundated sites that were dry at the end of the last glaciation. I am also interested in bogs and other wet areas and in applying technology to other archaeological sites, such as wrecks, cartways etc. I have recently become an IQUA member and I am looking forward to meeting many of you and, hopefully, to working with many of you in Ireland.

**Jerry Sawyer, City University of New York**

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## New Members

We welcome four new members to IQUA; Jerry Sawyer and Michael Kimbell from the USA, Corinne Feiss from France and Rosemary Charlton and Brid Bhean Uí h-Aonghusa from Ireland. We are now getting contacts via the World Wide Web page being run by Fraser Mitchell and encourage any member who knows of overseas interest in IQUA to publicise the WWW pages.

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## IQUA e-mail Bulletin Board

If any member has changed their e-mail address or recently acquired an address and wants access to the Bulletin Board then please send e-mail to Kevin.Barton@ucg.ie

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## Recent publications on Quaternary research in Ireland

- Ahlberg, K., Almgren, E., Wright, H.E., Ito, E. and Hobbie, S. 1996. Oxygen-isotope record of late-glacial climatic change in western Ireland. *Boreas*, **25**, 257-267.
- Coxon, P. 1997. Cenozoic: Tertiary and Quaternary (until 10,000 years before present). In: Holland, C.H. (Ed.). *A Geology of Ireland*. (2nd ed.). Scottish Academic Press, Edinburgh,
- Coxon, P. 1997. The chilling facts about global warming. *Technology Ireland*, **29**, 16-19.
- Coxon, P. and Coxon, C. 1997. A pre-Pliocene or Pliocene land surface in county Galway, Ireland. In: Widdowson, M. (Ed.). *Palaeosurfaces: Recognition, Reconstruction and Palaeoenvironmental Interpretation*. Geological Society (Special Publication No. 120), Bath, pp. 37-55.
- Coxon, P. and Waldren, S. 1997. Flora and vegetation of the Quaternary temperate stages of NW Europe: evidence for large-scale range changes. In: Huntley, B. (Ed.). *Past and Future Environmental Changes: the spatial and evolutionary response of terrestrial biota (NATO ASI Series, Vol. I 47)*. Springer-Verlag, Berlin, pp. 103-117.
- Edwards, K.J., Dugmore, A.J., Buckland, P.C., Blackford, J.J. and Cook, G.T. 1996. Hekla-4 ash, the pine decline in Northern Ireland and the effective use of tephra isochrones - comment. *Holocene*, **6**, 495-496.
- Hall, V.A., Pilcher, J.R. and McCormac, F.G. 1996. Hekla-4 ash, the pine decline in Northern Ireland and the effective use of tephra isochrones - reply. *Holocene*, **6**, 496-497.
- Huang, C.C. and O'Connell, M. 1996. Radiometric dating of the recent lake sediment from Ballydoo Lough, Cornamona, Co. Galway, Ireland. In: Liu, T., Luo, L., Huang, C.C., Guo, Y. and Zhang, D. (Eds.). *Environmental Change and Quaternary Research - Proceedings of International Conference on Quaternary High Mountainous Regions (ICQMR)*. Southwest China Normal University Press, Chongqing, pp. 15-22.
- Knight, J. and McCabe, A.M. 1997. Drumlin evolution and ice sheet oscillations along the NE Atlantic margin, Donegal Bay, western Ireland. *Sedimentary Geology*, **111**, 57-72.

- McVicker, S.J. and Hall, V.A. 1997. Recent landscape history of Slieve Muck, Mourne Mountains, Co Down. *Irish Naturalists' Journal*, **25**, 353-358.
- Meehan, R.T. Warren, W.P., Gallagher, C.J.D. 1996. The sedimentology of a Late Pleistocene drumlin near Kingscourt, Ireland. *Sedimentary Geology*, **111**, 91-105.
- Mitchell, F.J.G. and Delaney, C. (eds) 1997. *The Quaternary of the Irish Midlands*. Field Guide No. 21. Irish Association for Quaternary Studies, Dublin. p 84.
- Molloy, K. 1997. Prehistoric farming at Mooghaun - a new pollen diagram from Mooghaun Lough. *Archaeology Ireland*, **11**, 22-26.
- Monaghan, N.T. 1996. Radiocarbon dates for European elk *Alces alces* from Ireland. *Irish Naturalists' Journal*, **25**, 226.
- O'Connell, M., Molloy, K., Usinger, H. and Dörfler, W. 1997. Coring deep calcareous lakes in south-east Clare and Inis Oírr (Inisheer), western Ireland, towards the reconstruction of Late-glacial and Holocene environments. *Würzburger Geographische Manuskripte*, **41**, 151-152.
- Rafty, B. 1997. *Trackway Excavations in the Mountdillon Bogs, Co. Longford 1985-1991*. Crannog Publications, Irish Archaeological Wetland Unit, Dublin.
- Sweeney, J. (Ed.) 1997. *Global Change and the Irish Environment*. Irish Committee for IGBP and Royal Irish Academy, Dublin.
- Wilson, P. and Braley, S.M. 1997. Development and age structure of Holocene coastal sand dunes at Horn Head, near Dunfanaghy, Co. Donegal. *The Holocene*, **7**, 187-197.

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IQUA wishes to acknowledge the support of our Corporate and Institutional members GeoArc Ltd, Coillte Teo, John A Wood Ltd, Natural History Museum, London, Roscommon County Library and Ex Libris, Frankfurt.

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Contributions for the next IQUA Newsletter to be sent to: Dr Karen Molloy, IQUA Newsletter Editor, Palaeoenvironmental Research Unit, Department of Botany, NUI, Galway.

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