



Editor: Ellen OCarroll

1. Introduction

Dear IQUA member,

Welcome to Newsletter no. 51.

We had a full house and a fantastic mix of speakers from many different disciplines who gave very interesting and thought-provoking talks at the IQUA spring meeting on Saturday the 27th of April. The Spring meeting was hosted by the Palaeoenvironmental Research Unit, School of Geography and Archaeology, NUI, Galway. The conference was followed by a wine reception also sponsored by the Palaeoenvironmental Research Unit. We would like to thank Karen Molloy and Aaron Potito for organising such a stimulating meeting, and thanks also to the Palaeoenvironmental Research Unit for their warm welcome and sponsorship of the day. The student prize was presented to Karen Taylor from the Dept. of Geography, NUI Galway, for her interesting and articulate talk on Palaeolimnological impacts of early prehistoric farming at Lough Dargan, County Sligo, Ireland. Indeed it was very difficult to decide on the student prize as the standard of speakers and current research was of a particularly high standard. We are delighted that so many students were able to present their results at the Spring Conference. Thanks also to all who attended the Spring Meeting and AGM and the tour which followed on the Sunday.

We would particularly like to thank Michael Gibbons and Gordon D'Arcy who brought us back in time on a tour of archaeological sites and local wildlife, including a group of cairns on Ballyvaughan Bay, a seaweed farm visible in the inter-tidal zone on Auginish Island and a complex of midden sites on Kinvara Bay (see item 3 for abstracts of Spring Conference including details of the field trip and sites visited written by Andrea Waitz and beautifully illustrative photographs supplied by Pete Coxon).

This year we have a few changes to the IQUA committee following the AGM (see item 2). Thanks to all the committee for such hard work and behind-the-scenes organisation to make IQUA such a successful and lively association. A very warm welcome to our new committee members Kieran Craven (publications officer), Karen Taylor (postgrad rep) and Andrea Waitz (ordinary). Otherwise the committee remains as last year apart from Steve McCarron's departure and Rory Flood changing status from postgrad rep to ordinary member.

Looking forward to the second half of 2013 we have included the programme for the annual fieldtrip to North Mayo (20th – 22nd September 2013). The fieldtrip will include a visit to Belderrig and Céide fields and will include insights into and tours of the archaeological and palaeoenvironmental research that has taken place in this area over the past 30 years (see item 4 for details). We are very lucky to have Seamus Caulfield, Dr. Graeme Warren, Dr. Steve Davis and Michael Philcox as our experts for the weekend. They will show us around this landscape which hides a wealth of prehistoric remains beneath its peat layers. Glacial sections in valleys east of Belderrig as far east as Ballycastle will also be visited, as well as glaciotectionics sections around Killala Bay, including Kilcummin Head.

IQUA's Autumn Symposium on 'Dating the Irish Quaternary' will take place on the 29th November 2013 and is sure to be yet another highlight for all (see item 5 for more information).

There is also a new IQUA award to be presented this autumn (see item 7)

Thanks to all who contributed to this edition of the newsletter.

Kind regards,
Ellen OCarroll

2. IQUA Committee (2013/2014)

The IQUA Committee is as follows:

President: Prof Fraser Mitchell, TCD (continuing)
Secretary: Dr. Bettina Stefanini, NUIM (continuing)
Treasurer: Dr. Gayle McGlynn, TCD (continuing)
Postgrad rep: Karen Taylor, NUI Galway (elected)
Website manager: Dr. Francis Ludlow, TCD (continuing)
Publications Secretary: Dr. Kieran Craven, TCD (elected)
Newsletter editor: Dr. Ellen OCarroll (continuing)

Ordinary members: Dr. Steve McCarron, NUIM (continuing), Dr. Sarah Murnaghan, TCD (continuing), Dr. Steve Davis, UCD (continuing), Dr. Susan Hegarty, St. Patricks College, Drumcondra (continuing), Benjamin Thebaudeau, TCD (continuing), Andrea Waitz, TCD (elected), Rory Flood, QUB (continuing)

3. IQUA Spring meeting 2013

IQUA Spring Meeting Abstracts 2013:

Bualadh Isteach: The Drowned Archaeological Landscapes of the Burren Coast

Michael Gibbons, Walkwest, Clifden, Connemara

A recent archaeological survey along the north Burren Coast has revealed a wealth of previously undocumented archaeological sites and monuments spanning in date from the Mesolithic to the 19th century. These include the largest midden complex yet identified on the west coast; stretching along the sheltered bays of Ballyvaughan, Aughinish and Kinvara. The extent of the middens and their location in the intertidal zone suggests that much of this area has been drowned as a result of sea level rise. Some of this sea level rise appears to be quite late, perhaps post-dating the 10th century AD.

In addition to the earlier material a wide array of early-modern and modern vernacular remains is visible in the intertidal zone. An intriguing group of at least 5-6 stone cairns are visible on the coast at

Ballyvaughan at low tide in addition to a dozen vernacular quays and slips, some of which may date back to the late medieval period. These are complemented by extensive areas of prepared ground at Aughinish, constituting one of the best-preserved seaweed farms surviving on the Irish coast. Cultivated sea-weed was handled differently to weed carried in on the tide or blown in by the wind, which was known as “bualadh isteach” and in theory free for collection by all (although subject to an informal division depending on where it was blown in).

The seaweed farm by contrast, consisted of long parallel beds of stone (hundreds of metres long and 12 metres wide – some with kerbing at the edges) separated by cart tracks, laid down on the foreshore in order to encourage seaweed growth. The resulting crop was an important cash resource for the local community and the “seaweed-zone” was finely divided with each patch being jealously guarded and maintained by individual families. There are similar beds in Achill Sound and at Mill Bay, Co Down but these are not nearly as well preserved. Due to their current rarity, the Aughinish beds are of national importance and interest and are extremely vulnerable to damage from modern aqua-culture.

Poulnabrone Portal Tomb - Terrestrial Mollusca

Maria Long, Newtownshandrum, Charleville, Co. Cork

Land snail shells are often preserved for long periods of time and identification is generally possible from the shells alone, making them ideal candidates for use in archaeological studies. They can be particularly significant in calcareous and/or well-drained landscapes, where pollen may be poorly preserved (and conversely, shells optimally preserved). Only a few snail species are exclusive to particular habitat types, but by looking at the suites of species present, strong inferences of past habitat conditions can usually be made.

Samples of land mollusca were retrieved from deposits at the Poulnabrone portal tomb in the Burren, Co. Clare. A total of 27 species were recorded from 1,842 individual specimens. Eight of the 12 samples had sufficiently large numbers of shells to allow interpretation of habitat conditions, and in most cases, an open, rocky habitat is suggested. By far the most common species was *Pyramidula rupestris*, a species found only in

calcareous, open, rocky places. Small numbers of woodland specialists were found, hinting at the presence of nearby patches of woody cover, though the microclimatic conditions provided by grikes in limestone pavement must also be considered.

Overall, the findings point strongly to the fact that habitat conditions in the vicinity of the Poulcabrone portal tomb in the Neolithic were similar to those present today.

Palaeoecology: distant places, new perspectives

Michael O'Connell, Palaeoenvironmental Research Unit, School of Geography and Archaeology, NUI Galway

Conferences, meetings and associated field excursions provide important opportunities to learn, first-hand, of recent advances and new methodologies, and experience landscapes and sites that are already, or may yet come to be, of key importance in Quaternary research. IQUA meetings admirably fill this niche in the Irish context. In this presentation, the emphasis will be on exceptional Quaternary sites and associated research outside Ireland. Recent results from a selection of these sites, and their relevance within the Irish context, will be discussed.

Investigating the geochemical relationship between till and soil in Northern Ireland: fieldwork and results

Michael Dempster¹, Paul Dunlop¹, Mark Cooper², Andreas Scheib³

¹School of Environmental Sciences, University of Ulster, ²Geological Survey of Northern Ireland, ³Geological Survey of Western Australia.

Recent research using shallow soil sample geochemistry as a proxy for till geochemistry has indicated that till in Northern Ireland shows a close geochemical relationship to local bedrock, indicating that subglacial transport distance of entrained material was low in the study region. However soil is a product of, and is continually subject to, weathering processes so it is therefore crucial that the precise relationship of the till to soil geochemistry is established. In September 2012, 30 sites across Northern Ireland in regions of representative bedrock were sampled for soil and the underlying till. The 30 field sites included a

transect parallel to ice flow from the Lough Neagh Basin in county Antrim into county Down that crosses three lithological boundaries. Rates of debris entrainment along this transect have been investigated using clasts identified from the till sampled in the field. The soil and till sample element concentrations were determined by x-ray fluorescence and statistical analysis of the results show that the soil and till display a high degree of similarity in their geochemistry. The results confirm that shallow soil geochemistry can be confidently used as a proxy for till geochemistry in this sector of the Irish Ice Sheet.

Any luck? Early results on recent vibrocores off the north coast of Ireland

Benjamin Thébaudeau and Robin Edwards, School of Natural Sciences, Museum Building, Trinity College Dublin

For the last 3 years, a PhD project in TCD has been investigating the potential for recognition of submerged coastal landscapes on recent seabed mapping survey (JIBS) in the north of Ireland. This multi-disciplinary approach aims at recognising ancient coastlines corresponding to lowstands of the relative sea-level (RSL) in the Quaternary, and particularly in the last 20000 years since the last glacial maximum (LGM).

After a rapid overview of the geomorphological studies highlighting the wealth of offshore coastal features in the area and their meaning for palaeogeographic reconstructions, the talk will delve into the targeting of particular sites for coring in the study area. Initial compilation of available seismic data has allowed the recognition of sites with a high potential for understanding the stratigraphy of various bays in the study area. 14 sediment cores were collected last November aboard the ILC Granuaile in partnership with the GSI and although more analysis is necessary, preliminary results will be offered in the wider context of RSL change reconstruction.

A Palaeolimnological Assessment of the Influence of Climate Change and Human Impacts on Lakes in Western Ireland

Michelle McKeown, Geography, NUI Galway

Freshwater lakes are widely regarded as excellent archives of past environmental conditions, as they

are very sensitive and responsive to changing climate conditions and land-use change. Chironomid (non-biting midge fly) larvae contained within the lake sediments are the main focus of this study, as the life-cycle characteristics of chironomids are such that they are extremely sensitive to changing limnological conditions. In palaeoclimate research, there is a tendency to use chironomids to reconstruct temperature independent of human impacts, through the selection of sites which are isolated from human disturbance. In lower latitude and lower altitude locations, human settlement becomes more widespread; therefore, impacts on land become greater. Consequently, human impacts and climate change become more difficult to tease apart in chironomid reconstructions at such locations, and little work has been carried out in this area. This study investigates such a scenario using chironomid assemblages from three low-to mid-elevation lake sites which have been subjected to varying degrees of human interaction. Changes in lake ecology were reconstructed and compared with land-use histories within each lake catchment as well as the reconstructed temperature data from a local temperature record in order to assess the relative importance of climate change and human impacts for each lake through time. Therefore, the resilience of chironomids to human impacts on the catchment of three lakes can be assessed, in line with strength of these non-biting midges to infer summer air temperature.

Identifying Volcanic Signals in Irish Temperature Observations and Tree-ring Chronologies

Stephen Galvin, Geography, NUI Galway

Large volcanic eruptions have been shown to impact weather and, in turn, tree growth patterns to varying degrees on continental, hemispheric or global scales. However, few studies have systematically explored the influence of volcanic eruptions at a local, Irish level. The focus of this talk is to determine the impacts of five high-magnitude low-latitude volcanic eruptions and one such Icelandic event on Irish climate and ecology over the past ~200 years. Daily temperature data from Armagh Observatory, Co. Armagh are used to assess the influence of volcanic eruptions on seasonal and yearly values through time. Volcanically-induced temperature trends are explored by filtering out the influence of the North Atlantic Oscillation and solar variability, while a

variation of Superposed Epoch Analysis is used to identify which seasons and years are most significantly impacted by large volcanic eruptions. Meanwhile, correlations show that the months of November of the previous year to April of the current year are most important in terms of temperature's influence upon a newly-created *Taxus baccata* chronology from Killarney National Park, Co. Kerry. Here, the impacts of high-magnitude volcanic eruptions manifest as a notable downturn in growth in the two years following an event.

Negotiating the difficulties of synchronizing archaeological and climatic/environmental dating evidence

Thor McVeigh, Archaeology, NUI Galway

Interest in the impact of climate and environmental change upon past societies has increased considerably within the discipline of archaeology during the 21st Century. Numerous studies have suggested that fluctuations in environmental conditions can lead to various cultural and potentially political and/or religious responses. As such, it may be stated that changes in a society's environmental context may have identifiable repercussions upon the trajectory of societal development.

This presentation will discuss some of the difficulties and problems faced by archaeologists when attempting to synchronize archaeological chronologies with palaeoclimate and palaeoenvironmental data. These difficulties include differences in the resolution between archaeological chronologies and those presented within palaeoclimate and palaeoenvironmental studies; the utilization of differing dating systems, not only between the disciplines themselves, but even between researchers/studies and within individual papers; the tendency of some palaeoclimate and palaeoenvironmental researchers to present data graphically without the provision of results in a format easily accessible to archaeologists.

The presentation will then outline a number of archaeologically detectable patterns of socio-religious and/or socio-political change during the Irish Neolithic and Bronze Age (identifiable through alterations in monumental traditions, burial customs and material culture) that may be associated with climatic and environmental changes or oscillations.

A new Irish Interglacial site: Knocknacran, Co Monaghan.

Sebastian Von Engelbrechten¹, Fraser Mitchell¹, Pete Coxon², and Steve McCarron³

¹ Department of Botany, ²Department of Geography, Trinity College Dublin; ³Department of Geography, NUI Maynooth

Initial pollen analysis results from a six metre organic deposit filling a karstic depression within a gypsum deposit will be reported. The deposit is overlaid by a drumlin assumed to be of last glacial age. The pollen data show the early rise of thermophilous trees and their decline towards the top of the deposit suggesting that most of the interglacial has been recovered. At this stage, it is unclear which interglacial the deposit dates from and this question will be the focus of this paper. Previous research from the site on different deposits was reported in Vaughan et al. (2004) *Journal of Quaternary Science*, **19**, 577-590 but these appeared to have been redeposited. The new profile appears to be *in situ*. Organic matter in both this and the earlier investigated deposits is beyond the limit of radiocarbon dating. UTD dating reported in Vaughan et al. (2004) provided minimum age estimates of 41 ka and 86 ka.

**Annually-resolved natural climate variability during MIS 11
Where the wild-fires are... and *Homo heidelbergensis***

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Marine isotope stage 11 (MIS 11, ca 410,000 yrs BP) is considered to be one of the best analogues for current and future climate change due to the similarity of orbital forcing patterns during these two interglacials. Marine and ice-core records suggest that MIS 11 was a particularly long interglacial, characterised by stable climates. The investigation of high-resolution climate records from MIS 11 can, therefore, allow us to understand how the climate of a Holocene-like interglacial might evolve in the

absence of anthropogenic modification. MIS 11 sediments preserved in the palaeolake basin at Marks Tey, eastern England, offer the potential for such a study as they are considered to be annually-laminated (varved) throughout a large part of the interglacial (Turner, 1970, 1975). The lamination sets appear to be comprised, primarily, of three regularly occurring laminae types; 1) authigenic carbonate, 2) diatom blooms, and 3) organic detritus, although there appears to be some variability in the microfacies of these laminations. The carbonate laminations are the key to the study of climate variability during MIS 11, as they represent authigenic carbonate precipitation, consistent with temperature/biologically driven changes in lake chemistry during the summer months. Oxygen isotopic analysis of the carbonate therefore gives a proxy for summer temperature. A period of key interest in the MIS 11 sequence at Marks Tey occurs during the early part of the interglacial, where there is a short-lived increase in grass pollen relative to tree pollen, termed the Non-Arboreal Pollen Zone (NAPZ). The cause of this shift in pollen has been subject to debate, with natural wildfire (Turner, 1970) or climatic deterioration (e.g. Kelly, 1964) being suggested as possible forcing mechanisms. In this paper, as well as discussing the main characteristics of the MIS 11 sequence at Marks Tey, we will focus on the palynological, sedimentary, micromorphological and geochemical record of the NAPZ. In particular we discuss the potential role of abrupt, sub-Milankovitch, climate cooling in its genesis, whilst highlighting the complexity of ecological and landscape response that such a climatic event may generate. The study concludes by discussing the potential occurrence of 8.2ka-like events in pre-Holocene interglacials.

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Lateglacial and Holocene palaeoenvironmental change recorded in the peat floodplains and palaeochannels of the lower River Suck

Ro Charlton¹, Wim Hoek², Mark Macklin³, Kim Cohen², Paul Gibson¹ and Dorothy George¹
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²Utrecht University; ³Aberystwyth University

The peat-dominated floodplains, islands and palaeochannels of the lower River Suck provide a valuable archive of past changes in river flow and sediment regimes that have been driven by climatic variability and land use change within the catchment. An initial reconstruction of the Late Glacial and Holocene palaeoenvironmental history of the catchment is based on an integration of field observations, geophysics, core analysis, ¹⁴C dating, and LiDAR-based geomorphological mapping for a field site on the lower River Suck. These findings are considered in the context of existing data and understanding of palaeoenvironmental changes in the Irish midlands.

A complex assemblage of glacial features has led to the development of a tortuous channel pattern, an example being the large 'meanders' at Athleague. During deglaciation, glacial features appear to have led to the sequential damming of the valley at various locations, promoting lake formation. Dry valleys are incised in some glacial deposits that traverse the valley floor, and may have been associated with dam breaches and high-magnitude floods.

Research has focused on a former lake basin located on the lower part of the river, 4km north of Ballinasloe, which has an anabranching (multi-channel) form. ¹⁴C dating was carried out on samples from cores taken in fluvial depositional environments (river terrace, inset channel bench, bank) and from peat bogs. Cross-sections were also constructed from coring. A general sequence is described, with varved clays overlain by calcareous lake-fill deposits, which start at the onset of the Lateglacial (12530±130 BP). Atlantic peat formation started to occur as the Lateglacial/early Holocene as the lake started to become terrestrialised (6220 ±70 BP). During the Sub-Boreal/Sub-Atlantic incision took place, with clayey fill associated with increasing human activity starting to occur around 1195±35 BP.

Investigations of Cork's Origins

Anthony Beese, Consulting Geologist, Carraigex Ltd. Cork

Recent research (2009-2012) into the landscape archaeology of Cork was funded by the Heritage Council and supported by the Department of Archaeology, UCC. In its three phases, the study focused on archaeological excavations, historical maps and engineering boreholes, which are appropriate sources of information in the urban context.

A synthesis of the evidence has now enabled reconstructions of the evolving landscape. The story begins in the early to mid-Holocene, when a braided river system was established in the Lee valley. This fluvial environment persisted into the late Mesolithic period, and soon afterwards, was overtaken by an estuary as the marine transgression arrived from the east. The wetland environment seems to have remained unmodified until the medieval period, when Hiberno-Norse people began to reclaim the marsh islands. They did this by engineering a system of canals and new ground, thus enabling a settlement to be built on South Bank and South Island. This style of land-claim was continued by the Anglo-Normans who extended the occupied area across the full width of the Lee valley, so forming the medieval core of the city.

Poster Abstracts

Reconstructing historic and prehistoric eutrophication trends in a polluted freshwater lake

Carlos Chique, Geography, NUI Galway

This project will involve the analysis of a number of ecological indicators in sediment subsamples obtained from Lough Muckno, a highly polluted lake in Co. Monaghan. The lake has experienced long-term cultural eutrophication (nutrient over-enrichment) which has severely impacted the water quality of the lake and associated systems. Given the lack of long-term monitoring data for L. Muckno, a 'palaeolimnological' approach involving the reconstruction of water quality parameters through the analysis of subfossil ecological indicators obtained from the sediment record will be implemented. This reconstruction will be based on a comprehensive time-span aimed at identifying prehistoric to cotemporary human impacts.

The EU Water Framework Directive (WFD) requires member states to establish 'reference' conditions for deteriorated freshwater systems in order to set realistic restoration goals. This project will allow for identification of ecological 'reference' conditions, but will also document multiple eutrophication and recovery episodes through time, which can be used by environmental managers and policy-makers to more effectively manage our freshwater systems. The project will implement an innovative methodology which will ideally establish a solid precedent for further research in the field of lake restoration and aquatic science in an Irish context.

The Impact of Hurricanes on Ireland and Western Europe

Christina Connolly Johnston and Kieran R. Hickey, Geography, NUI Galway

Hurricanes form in the tropical zone of the Atlantic Ocean but their impact is not confined to this zone. Many hurricanes stray well away from the tropics and a small number even have an impact on the weather of Western Europe, mostly in the form of high wind and rainfall events. It must be noted that at this stage they are almost always no longer true hurricanes as they do not have the high wind speeds and low barometric pressures associated with true hurricanes. Their effects on the weather of Western Europe has yet to be fully explored, as they form a very small component of the overall weather patterns and only occur very episodically and rarely on a year to year basis.

The tail-end of Atlantic hurricanes and tropical storms occasionally can have catastrophic impacts on Ireland in particular but also Western Europe. Hurricane Debbie in 1961 was responsible for 17 deaths on the island of Ireland and extensive wind damage, Hurricane Charley was responsible for at least 5 deaths in Ireland and 6 more in the UK and cause extensive flooding in Cos. Wicklow and Dublin (Hickey and Connolly Johnston, 2012a). All though these two events are well known the impact of hurricanes and tropical storms is more frequent than previously understood. Ireland has been the most affected country in Europe by these events since 1960 (Hickey, 2011), (Hickey and Connolly Johnston, 2012b). The future vulnerability of Ireland and Europe to these events is also assessed.

References

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Transhumance in Irish settlement and society, c.1500-1900 A.D.

Eugene Costello, Archaeology, NUI, Galway

This research seeks to investigate transhumance in Ireland, c.1500-1900 AD, and to assess its social and agricultural role throughout this time. The primary aims are to: gauge the significance and range of transhumance prior to the major political and social upheavals of the later 16th and 17th centuries; ask what effect the latter had; assess the impact of 18th and early 19th century population growth, enclosure and upland improvement on people's ability to engage in seasonal movements; assess the social significance for communities of seasonal migration, and finally; determine when transhumance died out, bearing in mind variations in topography and socio-economic conditions. These aims will be pursued through desk and field research in three study-areas, the first being the Galtee Mountains, the second in Conamara, and the third to be confirmed. In each of these, documentary evidence (including placenames, ethnography, historical records and maps) will be examined. In addition, rapid survey of all likely booley houses will be conducted, supplemented by detailed survey of a select number. An assessment of the kind of vegetation near them will also be made. To date, it has been found that short-distance transhumance of dairy cattle survived in at least one area of the Galtees as a means of offsetting the pressures which pre-Famine overpopulation had placed on tenant-farmers. Transhumance may previously have operated on a larger-scale, but seems to have been curtailed by the expansion of settlement and enclosure from the 17th century. Attention has also been drawn to the

fact that booley houses in the Galtees are spread out rather than clustered, as they tend to be in Conamara and Achill Island. Future research will ask if permanent settlement patterns in the lowlands acted as a model for such distributions.

On the trails of the 'Invisible People': new approaches to understanding human settlement and climate change in the Irish Iron Age

Seamus McGinley, Geography, NUI Galway

For decades the Irish Iron Age has been a source of frustration for researchers due to the paucity of settlement evidence and the incomplete evidence for climate change, provoking Barry Raftery (1997) to describe the people of the Iron Age as the 'Invisible People'. The aim of this study is twofold; to provide a deeper understanding of changing settlement patterns in the Irish Midlands during the Iron Age, and to provide a more complete picture of temperature change for the period. It addresses the question how can we gain a better understanding of the Iron Age and the phenomenon known as the Late Iron Age Lull (LIAL). The LIAL (AD1-500) is a period of forest regeneration when, according to Weir (1995), severe climate downturn could have led to a widespread population decline. However, others including Plunkett et al. (2013) argue that lulls in activity around this time cannot be attributed to climate change.

The palaeoclimate literature is ambiguous, using terms such as 'colder/wetter' or 'warmer/drier' due to the lack of an independent temperature record. This study will provide a quantitative record of temperature change based on fossil chironomid (non-biting midge-fly) analysis from a high elevation lake that was isolated from Iron Age activity.

Chironomid analysis will also be performed on sediments cored from two midland lakes, i.e. Lough Lugh on the Hill of Uisneach, an important ceremonial site, and Mount Dalton Lough (3 km away from Uisneach), used to represent the wider landscape. Fossil chironomids from these sites will record changing levels of settlement activity, duration and intensity from the fluctuations in the trophic status of the lakes. The chironomid record will be supported by geochemical evidence, as lake sediment organic content, C:N ratios, $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ can all be used to infer dominant sources of lake sediment organic matter, nutrient cycling, agricultural inputs and erosion events (Last et al., 2002; Meyers and Teranes, 2002), and thus infer

changes in land-use practice, lake productivity and other catchment processes through time. These innovative techniques will enable us to test existing suggestions of population decline, expansion and nucleation during the Iron Age.

Palaeolimnological impacts of early prehistoric farming at Lough Dargan, County Sligo, Ireland

Karen Taylor, Geography, NUI Galway

This study provides a unique method of inquiry for archaeological investigation with an aim to assess the intensity and effects of Neolithic and Bronze Age farming practices at Lough Dargan, northwest Ireland, through a multi-proxy analysis of a lake sediment core. Chironomid (non-biting midge fly) subfossils and lake sediment geochemistry ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and C:N ratios) were used to assess changes in limnological conditions through time. The limnological data were compared with macroscopic charcoal concentration and pollen data to examine the potential influence that early farmers had on a freshwater lake system within a prehistorically active catchment. Results from the chironomid analysis show that the first substantial period of agricultural activity in the early Neolithic (c. 3730–3190 BC) resulted in a temporary shift to more eutrophic lake conditions. There is evidence of animal husbandry with substantial levels of animal waste reaching the lake, leaving an imprint in the geochemical record of increased $\delta^{15}\text{N}$ values and decreased $\delta^{13}\text{C}$ values and C:N ratios during this time. The chironomid community reverted back to its pre-impacted state c. 3190 BC in response to a period of reduced farming (c. 3390–3000 BC) which eventually led to a distinct lull in activity, with possible cessation of farming from 3000–2700 BC. A return to eutrophic conditions coincided with the gradual return of agriculture, with more permanently altered lake conditions dominating from 2400 BC, even during a 250-year period of reduced human activity commencing at c. 1440 BC. Increased sedimentation rate, along with increases in $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and C:N, the presence of chironomid taxa indicative of erosion, more eutrophic lake conditions and high concentrations of macroscopic charcoal all point to more intensive land use practices during the Bronze Age. Palaeolimnological data exhibited an immediate response to intensified farming during this time, and were especially responsive to pastoral farming due either to scale of activity or proximity to the lakeside. The success of this study demonstrates the effectiveness of palaeolimnological analysis in the investigation of

prehistoric farming. This approach will help inform Neolithic and Bronze Age land-use practice and human-environment relations in the region, and highlights the potential for chironomid-based archaeological research.

IQUA Spring Meeting Fieldtrip – 28th April 2013

Andrea Waitz, Department of Geography, TCD.

As part of the IQUA Spring meeting Michael Gibbons kindly volunteered to lead an archaeologically themed fieldtrip on Sunday the 28th April. The destinations were to be complex midden sites on Mulroneys Island and a medieval seaweed farm on Aughinish Island.

The field trip was well attended and over 30 people, both IQUA members and interested locals, met on this blustery Sunday morning at Kinvarra Harbour. After a short introduction as to the day's destinations a convoy left to meet again at the first field site.

Mulroneys Island

As the tide was still too high to cross over to the island our first visit was to a midden site on the main land, just south of the island. The area is very conspicuous as the oyster shells shine brightly through the sparse grass. While neither the deposits here or later on the island are radiocarbon dated, in this particular site the shell midden is utilised as foundation for a dry stone wall. It is therefore assumed that it predates medieval times.

The group then proceeded to visit the more extensive midden sites on Mulroneys Island itself. The first adventure of the day was to brave it across the 'causeway', which left more than one person worse for wear.



Crossing the causeway

On the whole the entire island can be describes an enormous midden site and exposures are plentiful along its shore. Two particularly large exposures are found on the north east side and the south; not only do they display extensive deposits of oyster shells but furthermore they contain charcoal fragments and even remnants of bone that provide the potential to date the deposits. However, at this point no absolute dating has been carried out so the ages of the deposits are not clear. Considering the extent of the deposits and their location under other human features such as dry stone walls, it is more than possible that they date as far back as prehistoric times.



Mulroneys Island

Michael Gibbons illustrated how societies in the past have, of course, always been exploiting natural resources in their vicinity. However, the scale in

which oysters and other molluscs have been harvested and processed in the area are quite astounding, as, according to Michael Gibbons, most of the islands in Kinvarra Bay show similar sized midden deposits. During the famine of the 1840s seafood was of course a vital supplement to the diet of locals but also as cash crop to sell in the local markets. Even today the cultivation and harvest of oysters and mussels continues in Kinvarra Bay.

The famine of the 19th Century left another mark on the island. In the north-eastern corner a famine grave is located, marked, in modern times, with a simple cross. The grave itself sparked an animated debate about the number of famine victims, both in the area and Ireland as a whole. Unregistered deaths, an insufficient census and migration within Ireland were all put forward as reasons. While no consensus regarding numbers could be reached it was at least agreed that the official records are most likely to be faulty.



Famine grave

On the tour of the Island Mr Gibbons pointed out several crude slipways along the coastline, marked only by the removal of boulders in a narrow corridor up shore. They are very numerous and easy to spot once one knows what to look out for. It is likely that they not only served the farmers to bring livestock onto the numerous islands in the bay but also to

facilitate the harvest, transport and processing of oysters close to their growing grounds.

After a few enjoyable and informative hours on the island the group returned to the cars for a short break, packed lunch and driving instructions to the next site.

Medieval Seaweed Farm - Aughinish Island

As the group arrived along the causeway to Aughinish Island, the seaweed farm extended across the mud flat to the south. Michael Gibbons told the group how he had come across the site by chance, observing linear structures across the shore and pondering about their origin.



Seaweed farm – above and below



In fact the linear formations are cart tracks that allowed easy access to all seaweed plots across the foreshore. It was pointed out how the normally shallow mud-flat had been covered with large rocks, usually between 30 and 50cm across that would allow the establishment of seaweed. After approximately 3 years the seaweed would be ready for harvested at which time the rocks would also be

turned over to prevent the build-up of mud and encourage a new crop.

Access and harvesting rights to the shore were of vital importance to many small farmers along the coast as seaweed was not only used to fertilise the fields and gardens of the area but also sold as cash crop at local markets.

As the fieldtrip participants explored the seaweed farm many other finds caused excitement such as sea anemones, small fish and crabs scuttling around the rocks.

Battling through seaweed and small streams to return to the cars it was late afternoon and the group dispended to make their way home after a great day in the field.

All field sites are easily identified on Google Earth:

- (1) Shell Midden, mainland - 53°09'05"N 8°56'5975"W
- (2) Mulroneys Island – 53°09'10" N 8°56'50"W
- (3) Medieval Seaweed Farm, Aughinish Island – 53°09'50"N 9°03'00"W

4. IQUA Annual Fieldtrip 2013 North Mayo Trip: 20 – 22nd Sept 2013

Provisional Schedule

Fri 20th Sept

19.30 – 20.30 'A landscape fossilised': archaeology and palaeoenvironmental research in North Mayo. A short presentation by Seamas Caulfield and Graeme Warren setting the context for the weekend fieldtrip by summarising ongoing fieldwork in the Belderrig region.

Wine and nibbles to follow.

Location: Belderrig Research and Study Centre (<http://www.belderrig.ie/Research.htm>)(see map).

After the talk, we can retreat to the Belderrig Bay Hotel i.e. 'The Pub'. While food should be available at the hotel later, it would be perhaps be advisable to take dinner before the talk.

Sat 21st Sept

09.00 – 13.00: Meet at Belderrig Research and Study Centre at 9am. The intention is for most cars to park up at the Centre, as space at the Harbour is restricted. Anyone arriving post 9.30 please rendezvous at Belderrig Harbour.

Walking tour of Belderrig. Including: Belderrig Harbour glacial sections (incl. 'shelly drift' (McCabe, 1986) & extensive sections east of Harbour); Mesolithic – Neolithic archaeological site at Belderg More (Warren 2009); Neolithic – Bronze Age prehistoric 'farm' at Belderg Beg (Caulfield 1978, 1983) and associated fossil pine forests (Caulfield et al 1998), and palaeoenvironmental sampling locations (Verrill & Tipping 2010 a & b).

13.00 – 14.00: lunch (soup & sandwiches) at Belderrig Research and Study Centre & short talk to introduce glacial history of area.

14.00 – 18.00: Tours of glacial sections in valleys east of Belderrig as far east as Ballycastle, time permitting (incl. Glenultra Valley; McCabe et al., 2007). Car sharing from Belderrig ideally. First Stop: Conaghra valley (GR 54.31, -9.50).

Evening meals: the pub in Belderrig does food, or pubs in Ballycastle. B&Bs may offer evening food. Please note this is not included in the fieldtrip cost.

Sunday 22nd Sept

On Sunday the Trip will proceed eastwards and not return through Belderrig.

10.00 – 12.30: Céide Fields: walking tour of Céide Fields including Behy court tomb and the visitor centre (Caulfield 1978, 1983, Caulfield et al 1998, Molloy & O'Connell 1995, O'Connell & Molloy 2001; see also Caseldine et al 2005).

12.30 – 1.30: Lunch available at Céide Fields café, or in Ballycastle. Please note this is not included in the fieldtrip costs.

1.30 - : Visit to glaciotectionics sections around Killala Bay; incl. Kilcummin Head (west side of Bay, 15km east of Ballycastle) and (optionally) Carrownedin, Enniscrone (east side of Bay; GR 54.23, -9.09).

Accommodation

In Belderrig:

Belderrig Bay Hotel: 096 43007
(<http://www.thebelderrigbayhotel.ie/>)

Hawthorns (B&B): 096 43148
(cataf.murphy@gmail.com)

Yellow Rose (B&B): 096 43125
(theyellowrosebandb@gmail.com)

In Ballycastle (15km to east)
Atlantic View (B&B): 096 43124
(griereileen@yahoo.com)

IQUA Newsletter no. 51 July 2013

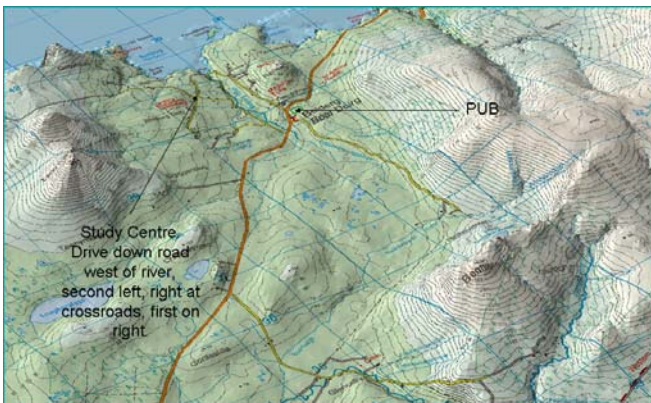
For accommodation elsewhere in north Mayo, see: <http://www.mayo-ireland.ie/> (Killala is 29km to the East of Belderrig, Ballina c. 40km.)

Fieldtrip Costs (incl. Lunch on Sat only & Guide):

Members: €20
Non-members: €30
Student members: €10
Student non-members: €15

Directions to Belderrig

The key meeting points are the Belderrig Research and Study Centre (<http://www.belderrig.ie/Research.htm>) and the Belderrig Bay Hotel after ~9.30pm on Friday evening. Both are marked on the map below. The Yellow Rose B&B is up the hill beyond the study centre (don't turn right at the cross roads) and the Hawthorns B&B is on the road on the east of the river, about halfway down. The AA routefinder (<http://www.theaa.ie/routes/#>) directions for "Belderrig Beg, Ballina, County Mayo" will get you there from just about anywhere.



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5. IQUA Autumn Symposium 2013

Venue: Geological Survey of Ireland Lecture Theatre, Ballsbridge, Dublin 4.

Date: Friday 29th November 2013

"Dating the Irish Quaternary" is the title of the upcoming autumn seminar which promises to be both vibrant and informative. Each speaker has been invited to talk about a different dating methodology or related topic and the line-up so far includes Prof. Colin Ballantyne (Glasgow University – Cosmogenic

dating); Dr. Gill Plunkett (Queen's University – Tephra chronologies); Dr. Graeme Swindles (Leeds University – Integration of different dating technologies) and Dr. Maarten Blaauw (Queen's University – Radiocarbon chronologies). The keynote lecture will be delivered by Prof. James Scourse (University of Bangor) who, in addition to heading up the Climate Change Consortium of Wales and founding the the Sclerochronology and Scleroclimatology Group at Bangor University, is one of the principle investigators on the BRITICE-CHRONO project which aims to constrain the timing and extent of the British-Irish Ice Sheet. All queries and suggestions should be directed to Gill Scott (gill.scott@gmail.com) or Bettina Stefanini (bettina.stefanini@nuim.ie).

6. Recent PhD completions

Testing the utility of an organic geochemical approach to Holocene sea-level change in the Shannon estuary.

Kieran Craven, TCD, cravenk@tcd.ie

Abstract

This project tests a recently developed, geochemically-based technique for relative sea-level (RSL) reconstruction to assess its applicability in the Shannon region. The technique is underpinned by the identification of altitudinal variations within intertidal sediment of $\delta^{13}\text{C}$ and C/N resulting from differential deposition of the two main sources of organic matter (OM) to saltmarshes: plant detritus and particulate organic matter (POM). Previous application in the UK has demonstrated the occurrence of these geochemical gradients across contemporary marshes and their preservation within the sedimentary record.

To assess the utility of this approach within Ireland, this study is broken into four main investigations into: 1/ the effects of acid pre-treatment methods to remove inorganic carbon; 2/ the occurrence of contemporary geochemical gradients of organic matter across intertidal sites; 3/ the alteration to geochemical values within recently buried intertidal sediment; and 4/ the occurrence of geochemical gradients in older Holocene sediment from the Shannon estuary.

For the first investigation, two acid pre-treatment methods were applied to replicate sediment from three saltmarsh sites prior to isotope ratio mass spectrometry (IRMS) analysis to allow inter- and intra-method comparison. It was found that while acid pre-treatment does cause variation in $\delta^{13}\text{C}$, $\delta^{15}\text{N}$ and C/N ratios, the magnitude of these differences is small when compared to the range of values encountered across the inter-tidal to supratidal environments of the study sites: C/N ranges are from 4-9; $\delta^{13}\text{C}$ from 4-11‰ and $\delta^{15}\text{N}$ from 6-10‰, compared to mean deviations due to acid pre-treatment method of up to 0.8 for C/N, 0.3‰ for $\delta^{13}\text{C}$ and 0.5‰ for $\delta^{15}\text{N}$. Consequently, any bias associated with the choice of acid pre-treatment is not sufficient to obscure source provenance in a contemporary environment.

The second investigation utilised IRMS analysis to identify OM source compositions and sediment geochemical gradients of OM from one saltmarsh site on the east coast of Ireland and three from the Shannon. It found three major OM contributors to contemporary marsh sites: C₃ plants, C₄ plants and POM. While the recent introduction to Ireland of C₄ plants complicates the geochemical gradients of modern marshes with non-linear $\delta^{13}\text{C}$ gradients with variation of 4.4-10.6‰ and C/N variation of 3.8-8.8, the computational package SIAR was used to solve mixing models and provide estimates of marsh geochemical signatures in the absence of C₄ plant input. Linear mixing of POM and C₃ plant OM are predicted in the absence of C₄ vegetation, with POM deposition reduced at higher elevations and estimated altitudinal variations across the intertidal zone are 0.9-2.4‰ and 3.8-8.8 for $\delta^{13}\text{C}$ and C/N respectively.

To identify post-depositional alteration for the third investigation, short cores were retrieved from two sites in the Shannon estuary. Radiometric analysis of ^{210}Pb and ^{137}Cs provided chronologies for the two cores up to 150yrs. IRMS, XRF and microfossil analyses were conducted to identify changes to organic tracers, inorganic tracers and foraminiferal assemblages. Geochemical interpretation of organic components matched that of the other two RSL proxy indicators and identified negative sea-level tendencies at the two locations. Reconstruction of OM sources from geochemical tracers via mixing models using SIAR suggested that source provenance interpretation was not obscured by diagenetic changes to OM. Marsh accretion rates of 6.7 -11.7 mm yr⁻¹ were recorded, outstripping regional RSL rise.

Detailed lithological and geochemical analyses from four sites in the Shannon estuary, together with three radiocarbon dates permitted new sea-level data to be retrieved during the fourth investigation. Following successful application of the geochemical RSL approach, intertidal sediments were inferred beneath a saltmarsh peat and one sea-level index point was established in the Fergus estuary. While co-varying $\delta^{13}\text{C}$ and C/N trends were identified across lithological contacts between minerogenic sediment and peats in the outer Shannon estuary, RSL-driven controls on OM input were rejected. Supra-tidal minerogenic sediments were inferred based at these localities from nitrogen isotopic values of $<5\%$ that are indicative of high contributions of terrestrial OM and C/N variations of 20-42 that are in excess of contemporary intertidal variation. These new sea-level data do not conflict with the most recent RSL simulations for the region but highlight that while the geochemical method has been shown to be applicable within intertidal sediments, an additional environmental proxy indicator is required to differentiate intertidal from supratidal deposits.

Late Quaternary sedimentation associated with the British-Irish Ice Sheet on the NW Irish continental slope: a marine geological and geophysical investigation.

Fabio Sacchetti, University of Ulster, School of Environmental Sciences, University of Ulster, Coleraine.
email: sacchetti-f@email.ulster.ac.uk

Four chapters of this thesis are already published in Journal of Maps, Marine Geology, Geo-marine Letters and Geomorphology.

Summary

This research demonstrates the impact that glaciations had on the geomorphology and sediment deposition of the NW Irish continental margin, including both sides of the Rockall Trough and the Rockall Bank. A modern hydrographic, geophysical and sedimentological approach is used to analyse and interpret new and historical datasets, including multibeam, sidescan sonar, seismic and core data. New methodologies such as CUBE and Geocoder algorithms for multibeam bathymetry and backscatter data processing, 3D visualisations, ArcGIS Spatial and Hydrological Analysis and digital X-Ray scanning are used to deliver an accurate geomorphological and sedimentological interpretation and to understand the changes that

occurred in the sedimentary processes from shelf edge to basin floor since the last glaciation, through deglaciation and in the Holocene. This research demonstrates a number of correlations between glacial geomorphology observed on the continental shelf and the various geomorphological and sedimentary features observed along the NW Irish continental slope and trough. It also provides extensive evidence that the Rockall Bank was scoured by several generations of icebergs and acted as a natural barrier against which icebergs coming from the western Atlantic Ocean grounded. Near seabed geophysical investigation throughout the Irish Rockall Trough is used to classify the area into six sedimentary provinces, each characterised by different depositional processes. This also provides new evidence of previously undetected mass transport deposits and extensive fluid-migration on a wide area of the trough. Finally, the study of sediment cores along two major canyons and across the trough provides a regional perspective on the sedimentary processes that took place since the last glaciation on the north-eastern margin of the Rockall Trough. The study reveals that margin physiography, distance from the ice sheet grounding zone, style of glaciation on the shelf and strength of deep sea circulation are the main controlling factors over the depositional processes.

7. Notices

*** New dating and analysis award ***

New dating and analysis award sponsored by IQUA and the CHRONO Centre, QUB open to IQUA members. Details will be sent through the mailing list. Alternatively contact Bettina Stefanini (bettina.stefanini@nuim.ie)
Closing date 31st October 2013

*** Bill Watts 14CHRONO Award 2013 ***

Congratulations to the winners of the 2012 Bill Watts 14CHRONO Awards, Donna Hawthorne, TCD, Philip Stastney, University of Reading and Marian McGrath, UCC The next round of applications will be open until 31st October 2013. For more details, contact Bettina Stefanini (bettina.stefanini@nuim.ie).

8. Forthcoming workshops, seminars & conferences

Geoscience 2013 is the annual two day event held by the Geological Survey of Ireland, the State's geoscience body at Dublin Castle between the **26th and 27th of November**. The meeting will be of interest to a broad range of participants, including: Local Authorities, Government policymakers, State Agencies involved in planning, environmental protection and human health: Third Level Institutes and other funding bodies; Private sector companies who use geoscience data in engineering, environmental and other studies.

Minister of State Fergus O'Dowd will open the meeting, which will:

- feature the latest developments from public, private and research sectors in Irish geoscience, with thematic sessions on Groundwater, Minerals, Geohazards, Marine & Urban Geology, and include updates from the INFOMAR and TELLUS Border projects and the Geoscience Ireland business cluster;
- look ahead to future projects under the Geoscience Initiatives 2 and Geoscience Research opportunities;
- include workshop sessions on GSI's work and research programmes.

To register your interest, please visit geoscience2013.eventbrite.ie. Please also indicate if you are interested in presenting your work, via a trade stand, a talk or poster forum.

Fragments of Lives Past NRA Seminar
Venue: Wood Quay Venue, Dublin Civic Offices, Dublin 8.

Date: 22 August 2013

To register please contact Lillian Butler at +353 1 6602511 or lbutler@nra.ie

Archaeofest 2013

As part of National Heritage Week the IAI and project partners DCC, UCD and DAHG are planning a one day event in Merrion Square on the **24th August**. The day will be a free event that aims to engage the public with our archaeological heritage and related arts in a fun, engaging and inclusive way. Demonstrations, experimental archaeology and talks will all form part of the day. Planned events include 'the Big Dig', hands-on demonstrations in flint knapping, geophysics, and archaeological survey. We also hope to have displays and demonstrations by environmental archaeologists, an archaeological poetry slam and 'soapbox'.

Further information will be posted on the iai website <http://www.iai.ie/> and Facebook page as it becomes available. If you are interested in getting involved please <mailto:info@iai.ie>

9. Recent Publications

Georgiopoulou, Aggeliki, Shannon, Patrick M, Sacchetti, Fabio, Houghton, Peter D W and Benetti, Sara (2013) [*Basement-controlled multiple slope collapses, Rockall Bank Slide Complex, NE Atlantic*](#). Marine Geology, 336. pp. 198-214.

Guo, X., A.P. Potito, L. Luo, and D.W. Beilman (in press) Twentieth century human and climate impacts on a large mountain lake in southwest China. *Hydrobiologia*.

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Ludlow, F., Stine, A. R., Leahy, P., Murphy, E., Mayewski, P., Taylor, D., Killen, J., Baillie, M., Hennessy, M. and Kiely, G. (2013) "Medieval Irish Chronicles Reveal Persistent Volcanic Forcing of Severe Winter Cold Events, 431-1649 CE", *Environmental Research Letters*, 8 (2), L024035, doi:10.1088/1748-9326/8/2/024035

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McKeown, M., A.P. Potito, and K.R. Hickey (in press) The long-term temperature record from Markree Observatory, County Sligo from 1842-2011. *Irish Geography*.

Stolze, S. 2012. Environmental change and human impact during the Neolithic in the Carrowkeel-Keshcorran area: evidence from Lough Availe. In S. Bettina and G. McGlynn, *Irish Quaternary Association, Field Guide No. 30, Roscommon and South Sligo*, 83-90. Dublin: Irish Quaternary Association.

Stolze, S., Dörfler, W., Monecke, T., Nelle, O. 2012. Evidence for climatic variability and its impact on human development during the Neolithic from Loughmeenaghan, County Sligo, Ireland. *Journal of Quaternary Science* 27, 393-403.

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Taylor, K.J., A.P. Potito, D.W. Beilman, B. Ghilardi, and M. O'Connell (2013) Palaeolimnological impacts of early prehistoric farming at Lough Dargan, County Sligo, Ireland. *Journal of Archaeological Science* 40: 3212-3221.

Wilson, P., Barrows, T.T., Lord, T.C. & Vincent, P.J. 2012. Surface lowering of limestone pavement as determined by cosmogenic (³⁶Cl) analysis. *Earth Surface Processes and Landforms* 37, 1518-1526.

Wilson, P. 2012. An unusual stone 'structure' on Slieve Donard. *Archaeology Ireland* 26(4), 26-30.

Wilson, P., Lord, T.C., Telfer, M.W., Barrows, T.T. & Vincent, P.J. 2013. Dating in the Craven Dales. *Geology Today* 29, 16-22.

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Wilson, P. 2013. Block/Rock Streams. In: Elias, S.A. (ed.), *The Encyclopedia of Quaternary Science* v. 3, 514-522. Elsevier, Amsterdam.

Wilson, P., Schnabel, C., Wilcken, K.M. and Vincent, P.J. 2013. Surface exposure dating (³⁶Cl and ¹⁰Be) of post-Last Glacial Maximum valley moraines, Lake District, northwest England: some issues and implications. *Journal of Quaternary Science* 28, 379-390.

Wilson, P., Barrows, T.T. & Lord, T.C. 2013. Reply to the comments of Faulkner on Wilson et al., 2012. 'Surface lowering of limestone pavement as determined by cosmogenic (³⁶Cl) analysis'. *Earth Surface Processes and Landforms* 37: 1518-1526. *Earth Surface Processes and Landforms* 38, 765-766.

10. General Membership Items

Please let your students/colleagues know about IQUA and encourage them to join.

Join/Renew IQUA membership online via PayPal

IQUA Newsletter no. 51 July 2013

We encourage all our members to update their annual subscription for 2013. The annual membership cost is: €15 waged; €10 students/unwaged.

IQUA offers a fast, safe, online payment system already familiar to many (**PayPal**) for joining IQUA or renewing your membership (!), and for purchasing past field guides (where available).

PayPal allows you to pay securely with your credit/debit card via the IQUA website:

<http://www.iqua.ie/membership.html>

If you do not have access to our online PayPal system, which is our preferred method of dues collection, please cut out and complete the following form and send it with a cheque for the relevant annual subscription to the IQUA Treasurer at the address below.

Cheques should be made payable to IQUA. It is suggested that, for their convenience, members may wish to pay two or three years' subscription in a single transaction.

IQUA membership form

Name:

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Telephone:

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Amount paid:

If you have any queries about IQUA membership, please contact the Treasurer.

Gayle McGlynn, IQUA Treasurer

Email: mcglyng@tcd.ie

Address: Department of Geography, Museum Building, Trinity College Dublin.

IQUA e-mail listserver:

<https://listserv.heanet.ie/iqua-l.html>

If you are not receiving IQUA listserv emails, please sign up to the list at the location above or contact Bettina Stefanini (bettina.stefanini@nuim.ie). A request for subscription to the IQUA-L list goes initially to the list moderator first for cross-referencing with the current membership list.

B. Stefanini, IQUA-L Moderator

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