



## 1. Introduction

Dear IQUA member,

Welcome to Newsletter no. 53.

Our first event of 2014 was held in University College Cork and included the Spring Meeting, AGM and a stimulating day of talks. We would like to thank Ben Gearey, UCC for organising such a successful Spring Meeting (see Item 3 for abstracts). Talks were varied and topical, and included a discussion of the recent severe storm damage that has ravaged our coastlines as well as looking at coastlines into the future and their past environmental history. Forest fires, which are increasingly more common in both tropical and temperate regions, were discussed and evaluated. Cultural topics included an unusual children's burial ground excavated in Mayo, Medieval land use and human impact on Irish peatlands in the past. An intriguing question was also posed in one of the papers: was there life before MIS3? Ireland may not have been totally bereft of animal life during MIS4 and perhaps there are indications of an even earlier mammal presence than previously thought. The student talks were of an exceptionally high standard and were all delivered very eloquently and succinctly. The postgraduate presentation prize was presented to Alwynne McGeever (TCD) for her talk: *Bog Pines in Ireland*. Thanks also to all who attended the Spring Meeting and AGM.

The AGM included the election of a new Chairperson – Dr. Catherine Dalton. Fraser Mitchell, our outgoing Chairperson, commented on how well IQUA had done during the year and how we were congratulated for our website, guides and events by other members of the Irish Geosciences Network. Dr. Gill Scott was elected as an ordinary member. We would like to welcome the new committee members and thank most sincerely the outgoing members who have contributed to the growing success of IQUA and its associated events. Gayle McGlynn presented the financial report at the AGM.

IQUA had had an exceptional year in membership subscriptions which is also a very welcome development.

Looking towards to the second half of 2014, we have included the programme for the annual fieldtrip on the theme of "Quaternary and Culture in Limerick" (19th – 21st September 2014). The fieldtrip will include a visit to Lough Gur and its associated archaeological remains, Grange stone circle and Mooghaun hill fort. Also included in the fieldtrip is a sail up the River Shannon and a look at the geomorphology and coastal sections around Scattery Island as well as the Mungret limestone quarry and Irish Cement. A varied and exciting fieldtrip trip to look forward to (see item 4 for further details).

IQUA's Autumn Symposium on 'Lakes: Reflections on the past' will take place on Friday 28th November 2014 and is sure to be yet another highlight for all (see item 5 for more information).

An update on the IQUA BID to host the XX INQUA Congress 2019 in Dublin is included in Section 7 below. A Provisional Committee list is also included and anyone who wishes to put their name forward for inclusion in the Committee is most welcome.

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

Kind regards,  
Ellen OCarroll

## 2. IQUA Committee (2014/2015)

The IQUA Committee is as follows:

**President:** Dr. Catherine Dalton, MIC, University of Limerick (elected)

**Secretary:** Dr. Bettina Stefanini, NUIM (continuing)

**Treasurer:** Dr. Gayle McGlynn, TCD (continuing)  
**Postgraduate rep:** Karen Taylor, NUI Galway (continuing)  
**Website manager:** Dr. Francis Ludlow, Yale University (continuing)  
**Publications Secretary:** Dr. Kieran Craven, TCD (continuing)  
**Newsletter editor:** Dr. Ellen OCarroll (continuing)

**Ordinary members:** Dr. Steve McCarron, NUIM (continuing), Dr. Steve Davis, UCD (continuing), Dr. Benjamin Thebaudeau, TCD (continuing), Andrea Waitz, TCD (continuing), Dr. Rory Flood, QUB (continuing), Dr. Gill Scott (elected)

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### 3. IQUA Spring meeting 2014

**IQUA Spring Meeting, University College Cork, Abstracts 2014:**

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#### **Topographic indicators of medieval land-use in Ireland: observations in the light of recent research**

Mick Corcoran  
*University College Dublin*  
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In what was more or less a critique of contemporary research into Irish medieval field systems, Butlin (1978) called for 'detailed regional and local investigations which are badly needed for medieval Ireland'. Thirty-five years later, where do we stand? Mainstream research into the development of Irish agricultural systems, by and large, has not moved beyond the traditional narrative of a 'Native-Norman' dichotomy wherein invading colonists stamped an 'English midlands' agricultural & tenorial structure onto a native Irish canvas of infield-outfield, largely pastoral landscapes. This arable-driven medieval economy then, according to the narrative, turned to favour large-scale pastoralism in the face of later medieval social, political and climatic upheaval. This shift was then reversed and repeated at several stages over subsequent centuries. Also implicit to this narrative is the idea that the division of Ireland into two broad agro-climatic zones – south and east vs. north and west (e.g. see Orme 1970) – reflected corresponding divisions in cultural identities and behaviours across the Irish landscape. There are a number of issues with this narrative. First of all it lacks the necessary resolution required to explore

local-scale agricultural decision-making and response to changing environments. Furthermore, there has been little structured attempt to combine the archaeological evidence with the wealth of environmental indicators of land-cover and -use.

This paper will outline a project currently being undertaken by the author. The aim of this research project is to address some of the issues mentioned above and to create a more accurate profile of changes in Irish agricultural practice, from the pre-Anglo-Norman late twelfth century to the beginning of the peak period of corn production and exportation in the late eighteenth century. The project will use a combination of landscape archaeological survey, palaeoenvironmental analysis and study of historical documentary and cartographic sources, focusing on three study areas in the south, east and west of the Republic of Ireland. The landscape survey component will adopt a multi-layered approach, observing landscapes using data from techniques such as LiDAR (Light Detection and Ranging), local area and site-specific mapping using GIS and sampling of material from specific locations for the analysis of pollen, testate amoebae and humification. This paper will explore the use of these techniques as well as examining the overall methodology. Most importantly it will present some of the preliminary findings of the project based on the analysis of LiDAR survey data.

Butlin, Robin A. 1978. Some observations on the field systems of medieval Ireland. *Geographica Polonica* **38**, 31-36.

Orme, A.R. 1970. *The World's Landscapes 4: Ireland*. London, Longman.

#### **Palaeo-archive Settings in Shallow Shelf Seas of North-West Europe**

M.Coughlan<sup>1</sup>, (m.j.c.coughlan@gmail.com), A. Wheeler<sup>1</sup>, B. Dorschel<sup>2</sup>, S. McCarron<sup>3</sup>, H. de Stigter<sup>4</sup>, W. Boer<sup>4</sup>, P. van Gaeve<sup>4</sup>, H. de Haas<sup>4</sup>, C. Lordan<sup>5</sup> and Mörz, T<sup>6</sup>.

<sup>1</sup> School of Biological, Earth & Environmental Sciences, University College Cork, Ireland.

<sup>2</sup> Alfred Wegner Institute, Bremerhaven, Germany.

<sup>3</sup> Department of Geography, National University of Ireland, Maynooth.

<sup>4</sup> Royal Netherlands Institute for Sea Research, The Netherlands.

<sup>5</sup> Marine Institute, Rinville, Oranmore, Co. Galway, Ireland.

<sup>6</sup> Department of Marine Engineering Geology, MARUM, University of Bremen, Germany.

The climatic development of the Mid to Late Quaternary (last 400,000 years) is characterised by fluctuation between glacial and interglacial periods

leading to the present interglacial, the Holocene. In comparison to preceding periods it was believed the Holocene represented a time of relative climatic stability. However, recent work has shown that the Holocene can be divided into cooler periods such as the Little Ice Age alternating with time intervals where climatic conditions ameliorated i.e. Medieval Warm Period, Holocene Thermal Optimum and the present Modern Optimum. In addition, the Holocene is recognised as a period with increasing anthropogenic influence on the environment.

Onshore records recording glacial/interglacial cycles as well as anthropogenic effects are limited. However, sites of sediment accumulation on the shallow continental shelf offer the potential to reconstruct these events. Such sites include tunnel valleys and low energy, depositional settings. In this study we interrogated the sediment stratigraphy at such sites in the North Sea and Irish Sea using traditional techniques, as well as novel applications of geotechnical data, to reconstruct the palaeoenvironmental record.

Within the German North Sea sector a combination of core, seismic and in-situ Cone Penetration Testing (CPT) data was used to identify sedimentary units, place them within a morphological context, relate them to glacial or interglacial periods stratigraphically, and correlate them across the German North Sea. Subsequently, we were able to revise the Mid to Late Quaternary stratigraphy for the North Sea using this new and novel data.

Similarly, Holocene environmental changes were investigated within the Irish Sea at a depositional site with active anthropogenic influence. The methods used included analyses on grain-size distribution, foraminifera, gamma spectrometry, AMS 14C and physical core logging. The investigation revealed a strong fluctuating climatic signal early in the areas history before anthropogenic influence affects the record through trawling.

### **Cyclic regeneration of dune systems after severe storm events: a case study from Connemara**

Pete Coxon,  
Department of Geography, Trinity College Dublin,  
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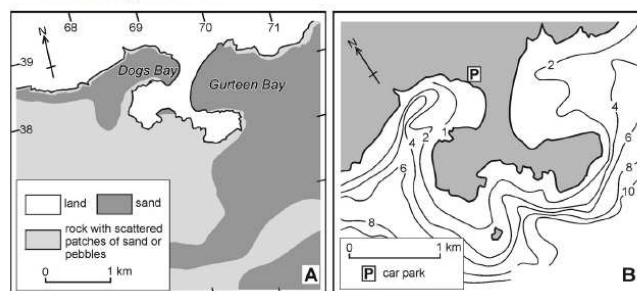
Severe weather conditions associated with storm surges and high tides during December 2013 and

January/February 2014 led to a succession of high magnitude storm events causing extensive infrastructural damage and geomorphological change along the west coast of Ireland. The storm events have provided an opportunity to appreciate the scale of damage that can be caused by winter storms and to subsequently monitor recovery of natural geomorphic systems. This paper will present preliminary data pertaining to the damage, erosion, transport and subsequent recovery of dune systems and beach sediment at Dogs Bay, near Roundstone, Connemara.

**Site 3.3a. Dogs Bay**  
(Starting point grid reference L 693 385)



**Figure 3.3.3. The tombolo seen from the north : Dogs Bay on the right, Gurteen Bay on the left.**



**Figure 3.3.4. Sea-floor characters of the area around Dogs and Gurteen Bays. A. Substrate types; generalized. Determined by sampling and diving by a group from University of Louvain, Belgium, 1979-80. B. Bathymetry in fathoms, at 2-fathom intervals.**

(from Lees 2005)

The tombolo that connects a former bedrock island to the mainland at Dogs Bay contains 2 beaches that are principally composed of, and are famous for, foraminiferal sand (see figure above and detail in Lees, 2005). The dune systems associated with the Dogs Bay and Gurteen beaches are important in a number of respects including as a grazing resource for local farmers, for their geomorphology, ecology and archaeology and for their use as a popular recreational resource attracting many visitors to the area. For these reasons the preservation and stability of the dune system is of vital interest both to the local economy and to natural science -and the impact of the storms of the 2013/2014 winter have caused some localised erosion of the landscape complex. The dune

system contains datable palaeosurfaces in the form of charcoal-rich palaeosols associated with abundant burnt stone, shell debris and more concentrated middens. There is an extensive lower soil possibly of bronze age origin and an upper soil that appears to be early christian (including a corn-drying kiln –Gibbons, 1991). There are many other lesser developed soils and associated fossil dune slacks and the history of the dunes is probably a mosaic of erosion and redeposition –the dunes themselves contain middens, stone structures, extensive prehistoric walls as well as bank and ditch structures. The palaeosols are interesting in their own right but they also provide evidence of surfaces that can be seen to have been stable for thousands of years in some areas and yet altered in others. The soils also indicate widespread cut and fill sequences in the dunes and give an idea of more stable areas.

This study looks at changes in the dune system over time thanks to both erosional features in the soils and to the collation of imagery of the dunes and beaches through the 20<sup>th</sup> century. An earlier study instigated after severe erosion and extreme storms in the late 1980s and early 1990s (Purton, 1991) not only catalogued dune blow-outs and erosion but also carried out accurate surveyed transects allowing the regeneration of the sand dunes since 1991 to be reconstructed. The original surveys, photographic record, sedimentology and the post 2013/2014 winter recovery of beaches and dunes should allow a longer-term management strategy to be put in place to preserve the resource and amenity that the dunes and beaches provide.

Gibbons, E. 199. Iorras Beag Thiar, Port na Feadoige (Dogs Bay) settlement site. In Bennet, I. (editor), *Excavations 1991*, No. 56, pp.19-20.

Lees, A. 2005. Sites 3.3a and 3.3b. Marine carbonate sediments of the Connemara coastal area: Examples from Dogs Bay and Mannin Bay. In Coxon, P. (ed.) 2005: *The Quaternary of Central Western Ireland: Field Guide*, Quaternary Research Association, London. pp 125-137.

Purton, L. 1991. *An investigation of the evolution of the Dogs Bay/ Gorteen Bay tombolo*. Unpublished BA Dissertation, Earth Sciences, TCD.

### **Rossbehy and Inch 'spits'- Palaeoenvironmental Change and Coasts of the Future (Key Note)**

Robert Devoy  
Emeritus Professor, UCC  
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The palaeoenvironmental and morphodynamic functioning of three closely linked spit-like structures are examined from the high energy Atlantic margin of Europe, at the head of Dingle Bay, southwest Ireland. The 'spits' are formed within a long (c.40 km) and narrow (c.10 km) sedimentary compartmentalised embayment and are controlled by a mixed wave and tidal dominated regime. The features demonstrate the quasi-unique, local (micro- to meso-scales) functioning of coastal systems. The 'spits' represent essentially composite beach- and dune-barriers, developed under Holocene sea-level rise (SLR) on N-S aligned glacial end-moraines formed at the end of the last glacial stage (MIS 2-4) and orientated normal to present onshore wave action. Minor drift aligned shoreline spits are found at the distal ends of these barriers. The two seaward fronting structures of Inch and Rossbehy are separated by an ebb-tidal delta and probably formed as a single barrier in the early- to mid-Holocene across Dingle Bay, before moving by *roll over* mechanisms to their present positions. Extensive back-barrier wetlands began to form behind this structure in the mid-Holocene. This earlier barrier was breached c. 3, 000 years BP, leading to the formation of the three present spit-like morphologies. Whilst the Inch Spit appears to be relatively stable today, Rossbehy Spit was breached by a storm surge in 2008 and continues to erode at rates of 30-50 m/yr along its core-length and at c.25 m/y on the seaward shore face, with the breach doubling in size to 1400 m wide from 2012-2014. Under future climate warming this structure is likely to disintegrate, with significant impacts on Inch and the morpho- and hydrodynamics of neighbouring coastal systems. The processes now in operation evidence the likely *coastal squeeze* that will occur on many World coasts under SLR in the 21<sup>st</sup> Century.

### **Irish Peatland Palaeohydrology, Past Human Activity, Complexity and Confusion?**

Benjamin Gearey<sup>1</sup> and Nóra Bermingham<sup>2</sup>  
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In this paper, we consider the use of palaeohydrological records to identify episodes of changes in bog surface wetness in Irish peatlands, and particularly their use in providing context for the archaeological record. We present multi-proxy palaeoenvironmental and archaeological data from the Lemanaghan complex, Co. Offaly, and consider the evidence for 'non-linear' processes in terms of past hydrological changes and the relationship with

episodes of human activity as reflected by the wetland archaeological record. We suggest that the data represent complex interplay of both allogenic and autogenic processes and consider the importance of distinguishing conceptually between 'palaeohydrology' and 'palaeoclimate' data, especially in terms of implications for past human activity in wetland and dryland landscapes. We will argue that a focus on site based processes of environmental change, rooted in an essentially archaeological rather than palaeoecological paradigm, offers a nuanced and balanced approach to characterizing local palaeohydrological changes and to characterising implications for past human activity and the archaeological record across variable spatial and chronological scales.

### **Igniting New Research: Fire, Vegetation and Climate dynamics throughout the Holocene, within the Galty Mountains.**

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Trinity College Dublin, College Green, Dublin 2,  
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In recent years fires have increased globally, in both tropical and temperate regions, as result of deforestation and drought, climate change, rural depopulation, and, paradoxically, through fire suppression. The future susceptibility to fire is predicted to be large, creating a major management issue throughout the warming world. This study looks at fire in Ireland over the past 12,000 years, in an attempt to understand its relationship with the surrounding vegetation and climate. How fire affects the landscape, how long an area needs to recover after a fire and also what conditions promote fire ignition. Two study sites are examined here, Borheen and Diheen Lough, both located within the Galty Mountains. Macroscopic charcoal analysis, pollen analysis and radiocarbon dating were applied to help understand the past fire and vegetation oscillations at these sites. Ireland is no exception to climate change and the projected increase in temperature and seasonality will have a significant impact on fire regimes. It is therefore important to examine previous fire and vegetation patterns to understand their nature and stimuli, to potentially project future patterns, mitigating the negative effects of fire in the future. This work is in its third year of a four year PhD programme supported by "The Earth and Natural Sciences Doctoral Studies Programme funded under the Programme for

Research in Third-Level Institutions and co-funded under the European Regional Development Fund."

### **Bog pines in Ireland**

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This study aims to characterise the growth of pine on bog surfaces in Ireland during the Holocene. To achieve this, 3 research topics were investigated: 1) The spatial and temporal distribution of pines on bog surfaces during the Holocene in Ireland. 2) The differences between pines on blanket bogs and pines on raised bogs. 3) The relationship between the growth of pine on bog surfaces and past fluctuations in precipitation.

Radiocarbon dates of subfossil stumps were collected from the literature, along with environmental data. Data were analysed using non-parametric statistical techniques. No distinct spatial pattern was found. Temporally, pines grew on bogs in 3 distinct phases; at 8000-7000cal BP, 6000-3000cal BP and 1500-500cal BP. Pines on blanket bogs occurred significantly further southwest, at higher altitudes and lived significantly longer than those on raised bogs. Studying the paleoclimate record, there were some associations found between the decline or absence of bog pines and shifts to a wetter climate. Based on these findings it is anticipated that the viable habitat area for bog pine woodlands in Ireland will be reduced as a consequence of ongoing climate change.

### **Stone Histories: occupation residues at the site of a children's burial ground at Tonybaun, Co. Mayo.**

Joanna Nolan  
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The burial ground excavated at Tonybaun was the final incarnation of activities at this location. The finds demonstrate a long period of use from the Mesolithic period through to recent times. These latest burial activities at the site have destroyed most traces of these earlier occupations, which can now only be identified through the assemblages of mainly stone finds recovered during the excavation. The use of stone resources is a consistent trait

throughout the long history of use here. The environment of the site contains a lot of evidence of ice movement. Such geomorphologic processes may have added to the range of stone resources available at this site. A consideration of whether such processes operated on these stone assemblages offers an opportunity to elucidate aspects of the occupation history here. Stone grave markers were recovered from the burial ground phase; these included artefacts and features that hint at Medieval occupation. The Iron age furnace pits demonstrate organised exploitation of local iron ore resources. The large assemblage of struck chert and flint is indicative of sustained prehistoric presence here. In the absence of related features, an examination of the derivation and modification of this material could increase understanding of the activities that generated it.

Nolan, J. (2006). Excavation of a children's burial ground at Tonybaun, Ballina, County Mayo. *Settlement, Industry and Ritual, National Roads Authority, Dublin*, 89-101.

### **Simulating Realistic Particle-Size Distributions Using Principal Component Analysis**

Sam Roberson  
*British Geological Survey, Belfast*  
Email: samrob@bgs.ac.uk

Geological models of grain-size distributions provide a means of assessing aggregate resources, informing groundwater modeling and guiding geotechnical surveys. Informing high-resolution geological models and soil maps requires a large volume of data to create realistic outputs. The high spatial density of borehole descriptions means that they have the potential to supply the majority of input data required for modeling. However, while some borehole descriptions include a quantitative estimate of the grain size, most are entirely qualitative.

This paper presents a method for simulating complete particle-size distributions from the statistical properties of a benchmark lithofacies database from the Netherlands. Principal component analysis is applied to *logratio* transformed particle-size distributions, sub-sampled from each lithofacies type. We identify the number of significant components for each lithofacies and describe each set of eigenvalues using mean and standard deviation statistics. These statistics are used to simulate random eigenvalues using a Gaussian model. The product of the simulated eigenvalues and the correlation matrix are added to

the mean sample distribution to yield a realistic *logratio* particle-size distribution. Logratio grain-size distributions are then back transformed to percentage frequency values that can be used to inform a geological model.

### **Coastal peat deposits, their environmental history and record of human impact, a case study from Tralong Bay, Co. Cork**

A. Waitz<sup>1</sup>  
*Department of Geography, School of Natural Science, Trinity College Dublin, Dublin, Ireland*  
Email: anu.ogma@gmail.com

The rich peat deposits in Ireland have long been used to reconstruct past environments and palynological research reaches back to the 1940s with the pioneering work carried out by Jessen in the 1930s and 40s. While early research focused on relative changes in species abundance, improvements in dating technologies and interests in human-environment interactions have shifted the focus of work to more interdisciplinary areas.

This PhD project focuses on peat deposits located at or below sea-level, giving a unique insight into the development of coastal vegetation. Furthermore, the research locations are associated with human habitation sites allowing for the assessment of human impacts on coastal areas. The most important study site is located at Tralong Bay, Co. Cork, Ireland, located in close proximity to a Bronze Age Stone Circle and hut site at Drombeg. Over 6m of sediment cores were recovered from the site and samples were processed in the laboratory for palynological investigation and loss on ignition analysis. Radiocarbon dates were obtained to give a time frame to the deposits, which place the oldest at 5704 ±46 BP.

To date investigations have focused in a 4m core obtained from the foreshore. In particular at 125cm a distinct peak in charcoal in association with a sharp decline in *Quercus* shows a potential human influence i.e. the removal of *Quercus* from the area. At the same time a sharp rise in *Rumex* supports this evidence as *Rumex* is often an indicator of open ground as is the observed expansion of Polypodiaceae. A further indicator for human presence in the area from this time onwards is the increased occurrence of larger Poaceae pollen grains (> 40µm), possibly indicative of arable farming.

While none of the indicators would warrant the conjecture of human presence and interference in the area by itself, the combined evidence is compelling. Based on the Drombeg radiocarbon dates and their associated large error (the earliest 1520 +/- 120 BC) the first presence of humans could be readjusted to about 2600 cal BC, 1100 years earlier than Drombeg suggests. The appearance of cultivated-type Poaceae pollen (> 50µm) in the upper zones certainly confirms the presence of human activity in the area at a later stage.

A distinct change in peat type, from a woody to *Phragmites* dominated peat is observed at 40cm (130cm below OD). It is yet unclear whether this change is related to a change in the local hydraulic regime or is results of a more widespread change in climatic conditions. However, it is interesting to note that its estimated timing coincides with Baillie's narrowest tree ring event at 2345 BC and the Hekla 4 eruption event (2310 +/- 20 BC). It is clear that the Tralong site has great potential in the area of identifying prehistoric human-environment interactions. The potential for the identification of established eruption events would not only further constrain the radiocarbon dates obtained but would also allow for the placement of the deposits within the wider European context.

#### **Was there life before MIS3?**

Peter Woodman  
*Emeritus Professor, UCC*  
Email: P.Woodman@ucc.ie

The Irish Quaternary Faunas project demonstrated in the 1990s that during MIS3 there was a very rich mammalian fauna present in Ireland. However advances in sample preparation are, in a continuing re analysis project, already showing that the mammal presence in MIS 3 in Ireland may have been more complex than expected. In particular certain dates are at the limit of radiocarbon dating's potential i.e. approx. 50ka. This fact along with other faunal remains could suggest that Ireland may not have been totally bereft of animal life during MIS4 and perhaps there are indications of an even earlier presence. This paper will re-examine a range of evidence from both Antiquarian sources as well as other indications based on more recent research. The evidence for an earlier mammalian fauna is sparse and perhaps could be subject to a number of different interpretations.

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## **4. IQUA Annual Fieldtrip 2014 Quaternary and Culture in Limerick Trip: 19<sup>th</sup> – 21<sup>st</sup> Sept 2014**

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Provisional Schedule:

#### **Friday 19th**

Evening Talk(s) from 7.30 pm at Greenhills Hotel, Ennis Road Limerick – **to be advised (tba)**

#### **Saturday 20th**

- Mungret limestone quarry & Irish Cement – **Michael Philcox**
- Grange Stone Circle – **Rose Cleary - UCC**  
*Lunch at Reardons (Holycross) or Old Bakehouse (Bruff)*
- Lough Gur - **Rose Cleary** (Archaeology);  
**Richard Langford** (Geotechnical Survey)  
*Evening free – check out City of Culture events*  
*(<http://limerickcityofculture.ie/>)*

#### **Sunday 21st**

- Mooghaun Late Bronze Age Hill fort, Dromoland Co. Clare - **Karen Molloy**  
*Lunch at Crottys Pub Kilrush*
- Scattery Island — **Michael Philcox**; Monastic Settlement (**OPW Guide**)
- Shannon Estuary boat trip (weather permitting) - **Kieran Hickey** (Reclamation, tsunamis and rising sea levels); **Kieran Craven** (Sea-level reconstruction)

Note: The boat trip up the Shannon Estuary will have a maximum 30 passengers and an extra cost of €45 per person. There are still some places available. To reserve a place please email [catherine.dalton@mic.ul.ie](mailto:catherine.dalton@mic.ul.ie). Alternative land-based sites are also being planned in the event of adverse weather.

**Accommodation:** A block booking for the IQUA group has been made in the Greenhills Hotel <http://www.greenhillsgroup.com> which is on the Ennis side of Limerick, near the Coonagh Roundabout. B&B will be €45 per person sharing. Tel: 061 453033. Other Accommodation close by – Travelodge - <http://www.travelodgelimerick.com/>



### **Payment**

The field trip fee is €20/30 for IQUA members/non-members and €10/15 for student members/non-members - this includes a printed field guide.

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## **5. IQUA Autumn Symposium 2014**

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

Date: Friday 28th November 2014

"IQUA's **2014 Autumn Symposium** will take place on **Friday November 28th** in the Geological Society of Ireland's Lecture Theatre, Beggar's Bush, Dublin 4. This year's symposium theme is entitled, "**Lakes: Reflections of our past**". The symposium will feature a range of speakers from Ireland and the UK covering different aspects of lacustrine research. The line-up so far includes Prof. Michael O'Connell (NUIG - Lake sediment archives); Prof. Phil Jordan (University of Ulster – Modern: lake eutrophication trends and recovery); Dr. Aaron Potito (NUIG – Biological proxies: chironomids); Dr. Micheline Sheehy-Skeffington (NUIG – Turloughs). Keynote lectures will be delivered by Prof. Chris Caseldine (University of Exeter - Growing importance of Quaternary science) and Dr. Cathy Delaney (Manchester Metropolitan University - Glaciolacustrine sediments and landforms). All queries and suggestions should be directed to Karen Taylor ([k.taylor1@nuigalway.ie](mailto:k.taylor1@nuigalway.ie)) or Bettina Stefanini ([bettina.stefanini@nuim.ie](mailto:bettina.stefanini@nuim.ie))."

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## **6. Recent PhD completions**

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Congratulations to Rory Flood and Benjamin Thébaudeau, IQUA committee members, who recently completed their PhD's and graduated in style. Abstracts and photos below!



Rory Flood (above) and Benjamin Thébaudeau (below) on their graduation day



### **Post Mid-Holocene sedimentation of the West Bengal Sundarbans**

Rory Flood, QUB, [rflood02@qub.ac.uk](mailto:rflood02@qub.ac.uk)

#### **Abstract**

The Sundarbans is one of the largest coastal wetland sites in the world that covers an area of approximately one million hectares in the delta of the Ganges and Brahmaputra (G-B) rivers located across Bangladesh and India. The Sundarbans is made up of a vast network of tidal creeks and deltaic islands with sediment deposition arriving from the G-B river systems draining the Himalayas.



The G-B delta is composed of two main systems with a fluvial and non-fluvial system characterising the eastern and western delta, respectively. This research set out to examine sedimentation taking place in the western, 'abandoned' tidal delta over the course of the mid-to-late-Holocene epoch, c. last 4000 cal yr BP. The primary assertion regarding the Holocene evolution of the lower Ganges-Brahmaputra delta plain in the Sundarbans is that from approximately 5000 cal yr BP the Ganges underwent avulsion (i.e. a 'switch' in the course of the river). This avulsion led to the Ganges joining up with the Brahmaputra in the eastern delta complex, with the western delta complex now considered to be largely abandoned as a result.

This project sought to test those assumptions garnering the late-Holocene evolution of the western delta complex through a series of percussion cores retrieved from the West Bengal Sundarbans, in India. A sedimentary facies analysis scheme through the use of grain-size distributions, mineralogy, and high-resolution core-scan derived geochemistry was carried out in order to determine dominant depositional processes and provenance of sediments. Along with these approaches, the depositional rates of the Sundarbans were examined through the use of  $^{14}\text{C}$  radiocarbon dating. As a result of developments in the calibration of core-scan Energy Dispersive X-ray Fluorescence Spectrometry (ED-XRF), a novel statistical framework grounded in the compositional data analysis (CoDa) approach was employed extensively in this project.

The depositional environment is characterised by a sedimentary facies record similar to that of a muddy-tidal flat with a dominant fining-up of the grain size distributions, capping what may potentially consist of sub-tidal ridges. Radiocarbon results reveal an overarching trend in stratigraphically anachronous dates that are potentially indicative of fluctuating depositional processes present throughout the Sundarbans. Sedimentation processes in the Sundarbans appear to reflect the ebb- and flood-tidal conditions which may be overprinted by monsoonal variability. Sedimentary provenance is dominated by a mixed Ganges-Brahmaputra source, composed mainly of silicate weathering products, with the possibility of greater Ganges inputs.

The Ganges-Brahmaputra delta is the second largest delta in the world after the Amazon and before the Mekong and is considered to be the most complicated deltaic system (Anthony, pers. comm., 2014). The results from this PhD research reflect

that complexity with depositional processes dominated by tidal variability and to some degree inextricably linked to the Indian Ocean monsoon. Sediment provenance reflects both the autocyclic and allocyclic nature of sediments. Sediments are composed primarily of terrigenous origin but coupled with the depositional nature of the western delta complex elucidated in this research reflect a great degree of reworking. The CoDa statistical framework represents one of the greatest advances in data analysis and without such a statistical framework the interpretation of the sedimentary dynamics of the West Bengal Sundarbans would have been impossible.

Future research on the Sundarbans should focus on the development of a morphosedimentary characterisation in order to assess sediment budgets and the physical properties of sediment deposition. Furthermore, the research approach developed in thesis may be further tested on examining the eastern delta complex in Bangladesh. Such research schemes may further expose the depositional behaviour of the Ganges-Brahmaputra delta and how this vast deltaic system has varied over both space and time.

### **Geophysical exploration for offshore evidence of relict shorelines on the northern coast of Ireland**

Benjamin Thébaudeau: Email: [thebaudb@tcd.ie](mailto:thebaudb@tcd.ie)

#### **Abstract**

The current generation of postglacial Relative Sea Level (RSL) change simulations in formerly glaciated margins display significant discrepancies with field evidence. This is particularly true in Ireland where the RSL history is strongly controlled by the combined effects of local ice loading and the influence of adjacent ice masses over Britain and Fennoscandia. On the northern coast of Ireland, the resulting complex interplay between glacioisostatic rebound and eustatic sea-level rise is expressed as an oscillating postglacial RSL curve that comprises intervals with sea levels both above and below present.

Reconstructions from both glacial rebound modelling or the interpretation of field data rely on sea-level data which have so far been entirely collected on land and dated mainly to the Holocene. The period of time when the RSL was locally below the modern sea-level is critical to our understanding of the region coastal evolution and formation. Published studies using local seismic data and

associated ground truthing coring survey have identified sub bottom features (palaeochannels) and depositional evidence (erosional surfaces) that suggest that current Glacial Rebound Models (GRMs) underestimate the magnitude of postglacial RSL fall for the northern coast of Ireland.

This study explores the recently collected Joint Irish Bathymetric Survey (JIBS), a multibeam high-resolution bathymetric survey, and the large corpus of seismic data collected over the last 15 years by the Environmental Sciences Research Institute (ESRI) from the University of Ulster for the northern coast of Ireland for any evidence of submerged relict shorelines to constrain the magnitude of the local postglacial RSL fall.

A marine terrace database is developed for the study area in order to study the morphological parameters of these features and the influence of the lithology of the rocks these features were formed in with their morphology. A wave erosion model is run using four of the recently published GRMs to test the origin of some of the recognised marine terraces where modelled output are compared to the measured profiles to select the parameters for the best fit. These simulations permit a first order assessment of the extent and distribution of potentially inherited features to be made. Local seismic data's stratigraphical sequence is explored for any depositional evidence of recent RSL change. The whole corpus of seismic data both already used in publication and more recently collected is consistently examined for ground truthing targets. Acoustic-lithological correlations is used to decipher the depositional scenarios of the cored areas which was then extrapolated to the whole northern Irish coast. 7 main phases of sediment deposition are recognised for the study area spanning from the LGM to the present.

This study highlights the difficulties in relating hard rock erosional coastal features to a contemporary RSL and as modern literature relative lack of interest to them shows, they are not the first line of evidence to use for postglacial RSL study. The much more precise information from the soft sediment stratigraphy is limited but allows to uncover some definite evidence for the timing and depth of the most recent lowstand. The comparison of both lines of investigations points to only a slight underestimation of the current GRMs' simulation of the magnitude of the last RSL lowstand. Furthermore, the westward differential glacial uplift consistently found in GRMs is somewhat visible in these new lines of evidence but not to the same extent as modelled. Hence for the study area, it

appears the current generation of GRM is appropriate at simulating postglacial RSL change but some recommendations can be made for their future improvement.

Hence by using a comprehensive and multi-technique study, this thesis makes a valuable contribution to the study of palaeoclimatology in terms of ice sheets distribution and development, RSL change and coastal geomorphology for formerly glaciated margins.

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## 7. Notices and Awards

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### \* Intention to bid to host the XX INQUA Congress 2019 In Dublin, Ireland \*



The Convention Centre Dublin -  
<http://www.theccd.ie>

Following the agreement at the 2014 AGM in Cork that IQUA should bid for an all-island hosting of the XXth INQUA Congress in 2019 to be held in Dublin a formal intention to bid has been made –see below.

The lead-in to the decision was made with a call for expressions of interest (in January 2014) for anyone wanting to be involved to contact Pete Coxon. The attached list of the Local Organising Committee (LOC) and the Scientific Programme Committee (SPC) is not final. IQUA will hope to include anyone willing to engage fully with the organisation of the Congress. Apologies if you contacted us and you are not yet included. This will change as people express interest in specific roles.

Following meetings in the coming Autumn the LOC/ SPC will be modified to include those who (at that stage) agree that they are willing to take on organisational roles. Specific engagement may include: registration, liaising with developing countries, looking for sponsorship and so on. Already IQUA members have started to organise a programme of formal pre- and post-Congress field

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excursions and all IQUA and QRA members will be circulated soon asking for their expressions of intent.

### The Formal Bid:

Dear INQUA Secretary-General,

I am writing to submit an intention to bid to host the XXth INQUA Congress in 2019 at the Convention Centre, Dublin, Ireland on behalf of the Irish Quaternary Association (IQUA - <http://www.iqua.ie>). The completed bid will be submitted on or before the deadline of April 30<sup>th</sup> 2015 and will be followed by our formal presentation to the International Council in Nagoya in July 2015.

I have appended below on page 3 a list of our provisional Local Organising Committee (LOC) and Scientific Programme Committee (SPC). The LOC and SPC contain a substantial number of active scientists who have extensive experience in organising large (including international) meetings. Our organising committees currently include the Presidents of both IQUA and the QRA. We have selected scientists with broad Quaternary interests and remain open to adding further active members of the LOC. We look forward to the INQUA Commissions having a major role in the SPC. IQUA has held meetings with the Dublin Convention Bureau (<http://www.dublinconventionbureau.com>) and with Irish Tourism (<http://www.failteireland.ie>) in order to secure the Congress venue (the Dublin Convention Centre) and support for the bid. Agreement in principle, as well as indications of support, have been obtained from these bodies for hosting the Conference.

We have ongoing and active contact with the Quaternary Research Association in the UK. The QRA has indicated its strong support and we have started the process of engaging with a professional conference organisational company in order to make a full and complete bid before the deadline of April 30<sup>th</sup> 2015.

We have identified a wide range of mid-congress field excursions and visits that will be suitable for scientific Congress attendees and their accompanying guests.

Field Excursions will be organised both before and after the Congress to Ireland and Britain. These excursions will be designed to give Congress participants the opportunity to visit the marvellous Quaternary sites available in both islands with expert leaders. The excursions will be designed to cover a wide range of Quaternary interests and be accessible to a variety of participants.

With every best wish



Pete Coxon (Chair of the provisional LOC Dublin 2019)

On behalf of the Irish Quaternary Association

### INQUA 2019 Dublin

#### Provisional Committees

#### Local Organising Committee INQUA Dublin 2019:

**Chair:** Peter Coxon (Trinity College Dublin)

**Vice-Chair:** Fraser Mitchell (Trinity College Dublin)

#### Field Excursions:

Stephen McCarron (National University of Ireland, Maynooth)

Bettina Stefanini (National University of Ireland, Maynooth)

Meetings Officer of QRA -tbc

#### Members:

Sara Benetti (University of Ulster)

Keith Bennett (Queen's University Belfast)

Tom Bradwell (British Geological Survey)

Catherine Dalton (University of Limerick)

Steve Davis (University College Dublin)

Catherine Delaney (Manchester Metropolitan University)

Paul Dunlop (University of Ulster)

Robin Edwards (Trinity College Dublin)

Gayle McGlynn (Trinity College Dublin)

Gill Scott (National University of Ireland, Maynooth)

Michael Sheehy (Geological Survey of Ireland)

#### Scientific Programme Committee INQUA Dublin 2019:

Geoff Duller (Aberystwyth, JQS Ed.)

Henry Lamb (Aberystwyth)

Francis Ludlow (Yale)

Colm O'Cofaigh (Durham University)

Michael O'Connell (National University of Ireland, Galway)

Paula Reimer (Queen's University Belfast)

James Scourse (Bangor, University of Wales)

Nicki Whitehouse (Plymouth)

Peter Woodman (University College Cork)

## \* Dating and analysis award \*

The new Dating and Analysis awards have been a great success. An abstract of the research associated with the C14 award presented to Anthony Beese is outlined below and shows the valuable contribution that these awards provide to IQUA researchers. The award is sponsored by IQUA and the CHRONO Centre, QUB and is open to IQUA members. Details will be sent through the mailing list. Alternatively contact Bettina Stefanini ([bettina.stefanini@nuim.ie](mailto:bettina.stefanini@nuim.ie))

Closing date 31<sup>st</sup> October 2013

### **Preliminary radiocarbon dating indicates that the marine transgression reached the locus of Cork in the Late Mesolithic or Early Neolithic (between 6.2 and 5.6 ky BP)**

**Anthony Beese**

The Holocene stratigraphy of the valley-fill at Cork City (River Lee) may be summarized as:

1. Fluvial deposits comprising sand and gravel with occasional organic interbeds (Ovens Formation), overlain by:
2. Estuarine mud comprising organic silt and peat (Cork Harbour Formation), overlain by
3. Anthropogenic deposits dating from the 11th/12th century (medieval period).

The chronology of the geological sequence is poorly known (Davis *et al.* 2006). However, a radiocarbon date (UBA-25884: Tuckey Street), awarded by the IQUA, has yielded an important result that builds on preliminary information obtained from two previous dates awarded by the RIA (UBA-18069: Grattan Street and UBA-20749: Woods Street). All three dates were obtained from wood fragments. The wood was present in soil samples that were recovered from engineering boreholes between 1992 and 1997. The fragments, which measure up to 20 mm in diameter, are interpreted as small broken branches of indeterminate type. Two of the dates indicate that organic interbeds within the fluvial sand and gravel (Ovens Formation) were deposited in the Late Mesolithic (4850-4249 cal BC), while the current date shows that peaty silt from the lower part of the Cork Harbour Formation accumulated in the Early Neolithic (3639-3514 cal BC). The results, therefore, bracket reasonably well the change from fluvial to marine conditions at the locus of Cork, although it is accepted that the transformation could have been later because the

wood is derived. Nevertheless, an important implication of the radiocarbon dates is that they demonstrate that both the fluvial and estuarine deposits are archaeologically significant.

A review of records of engineering boreholes and historical maps has enabled subsurface plans to be constructed ([www.corkorigins.ie](http://www.corkorigins.ie)) and these show that anastomosing channels characterized both the fluvial and estuarine environments. The organic interbeds, which are preserved only in the youngest part of the sand and gravel sequence, are interpreted as resulting from quieter conditions that occurred towards the end of the fluvial phase, while the overlying organic silt appears to have been deposited in a landscape that was dominated by mudflat and fringing reed marsh environments.

Careful selection of the samples was necessary because dating evidence from archaeological excavations shows that, during flood events, there has been reworking of the late Holocene sequence. Indeed, significant deposition of sand and silt occurred within reactivated tidal channels as late as the 10th century, shortly before the medieval land-claim.

Reference: Davis, T., McCarthy, I.A.J., Allen, A.R. and Higgs, B. 2006. Late Pleistocene-Holocene buried valleys in the Cork Syncline, Ireland. *Journal of Maps*, 2006, 79-93.

## \* Bill Watts 14CHRONO Award 2014 \*

Applications for the Bill Watts 14CHRONO Awards are also open. Details will also be sent through the mailing list or contact Bettina Stefanini ([bettina.stefanini@nuim.ie](mailto:bettina.stefanini@nuim.ie))

Closing date 31<sup>st</sup> October 2013

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## 8. Forthcoming workshops, seminars & conferences

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Fellows of the Geological Society

The Northern Ireland Regional Group was established at a business meeting on 21 May 2014. The new committee is: Chair: Mike Young (GSNI, Research Associate); Secretary: Thomas Cash (RPS); Treasurer: Sarah Coulter (Galantas); Members: Mark Kelly (MK Environmental), Paul McErlean (White Young Green), Jenny McKinley (Queen's); Ian Meighan (GSNI, Research Associate); Dermot Smyth (Lonmin); Simon Webber (Translink).

## IQUA Newsletter no. 53 July 2014

These events are now planned:

Sunday 28 September 2014

Visit to the Cavanacaw gold mine and Curraghinalt gold project, County Tyrone

Meet for a briefing and coffee at the Silverbirch Hotel, Omagh at 1000.

Numbers are limited for this trip: please contact Sarah Coulter at Galantas if you would like to go: [GeolSocNI@gmail.com](mailto:GeolSocNI@gmail.com)

Monday 13 October 2104

'Science and Stormont' seminar and exhibition, Parliament Buildings, Belfast.

This is the annual seminar staged by the All Party Assembly Group on Science and Technology. This year the topic is 'Science education in Northern Ireland'. We will have a stand in the accompanying exhibition. All are welcome.

Seminar: 1300-1715; exhibition and reception: 1730-1930.

Further details from Mike Young, [GeolSocNI@gmail.com](mailto:GeolSocNI@gmail.com)

Monday 27 October 2014

Reception and Inaugural Lecture: 'Geology and the low-carbon economy'

Professor Paul Younger DL, FREng, FGS, FICChemE, FICE

Ulster Museum, Belfast, 1830 – 2100

Paul Younger, Professor of Energy Engineering at Glasgow University is a leader in the field of geothermal energy development and the efficient use of fossil fuels. He was a member of the Royal Society/Royal Academy of Engineering panel that in 2012 published a major report on shale gas and he is Chair of the Advisory Committee of the British Geological Survey. No stranger to Northern Ireland, Paul spoke at the All Party Group meeting on renewable energy at Stormont in 2013.

To register for this event, please email Thomas Cash, [GeolSocNI@gmail.com](mailto:GeolSocNI@gmail.com)

May 2015

Field excursion (co-organised with GSNI and ICE) for the Engineering Group of the Geological Society. Details to come.

You are also very welcome also to support these forthcoming field-trips of the Belfast Geologists' Society:

2 August: Slieve Gullion and Carlingford (Ian Meighan, GSNI)

21 August: Belfast urban model, inside and outside (Sam Roberson, GSNI)

4 October: Structural geology of Loughshinny (John Walsh, UCD)

For more details please see: <http://www.belfastgeologists.org.uk/summerpage.htm>

I look forward to seeing you at some of these events.

Mike Young

Dear IQUA Colleagues,

It is our pleasure to welcome you to Queen's University Belfast to participate in the inaugural Radiocarbon in the Environment Conference which will take place from the 18-22nd August 2014. We hope to bring together colleagues from around the globe interested in the applications of radiocarbon and stable isotope methods in ecological and environmental research.

Radiocarbon can be used for much more than chronology. Natural abundance, bomb and enriched radiocarbon, in addition to stable isotopes, have all been used in ecological and environmental investigations.

We wish to invite you to register at this time: <http://www.qub.ac.uk/sites/14C/Registration/>

IQUA'S Bettina Steffanini will present her work at the conference and we think many other talks will be of interest to members. Check out the programme at:

<http://www.qub.ac.uk/sites/media/Media.451552.en.pdf>

The conference proceedings will also be published by international journal Radiocarbon (<http://www.radiocarbon.org/>).

More information can be found at:

<http://www.qub.ac.uk/sites/14C/>

or by contacting [14Cenv@gmail.com](mailto:14Cenv@gmail.com).

We hope to see you in Belfast this month!

The organising committee:

Paula Reimer  
Evelyn Keaveney  
Philippa Ascough  
Jesper Olsen

***'Stories of Ireland's Past: knowledge gained from NRA roads archaeology' will take place on Thursday thr 28th August at the City Wall Space, Wood Quay Venue, Dublin Civic Offices, Dublin 8.***

The discoveries that have been unearthed in the last 15 years in particular have significantly overhauled what we know about many periods of the prehistoric and historic past. This year's seminar features a stellar line-up of speakers drawn from universities across Ireland and the UK, all of whom are leading academics in their fields of research and have been keen observers of the fruits of 'roads archaeology' and development-led archaeology generally for many years.

To register please contact Lillian Butler at [lbutter@nra.ie](mailto:lbutter@nra.ie) or telephone +353 1 6602511. Please note that this is a FREE event.

#### **Archaeofest 2014**

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 23rd 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', sword fighting, geophysics demonstration, a bouncy dolmen and a tent full of specialists.

*Further information:*

**<https://www.facebook.com/events/259493670913922>**

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## **9. Recent Publications**

Ballantyne, C.K., Wilson, P., Gheorghiu, D. & Rodés, Á. 2014. Enhanced rock-slope failure following ice-sheet deglaciation: timing and causes. *Earth Surface Processes and Landforms* 39, 900-913.

Couto, H. and Knight, J. 2014. The Montalto Formation: a Pre- to Basal Ordovician Succession in the Dúrico-Beirã area (Northern Portugal). In: Rocha, R., Pais, J., Kullberg, J.C. and Finney, S. (eds), STRATI 2013 – First International Congress on Stratigraphy, At the Cutting Edge of Stratigraphy. Springer Geology, Heidelberg, 381-384.

Delman, J. and Ludlow, F. (2014) "The Past, Present and Future of Irish Environmental History", *Proceedings of the Royal Irish Academy*, 114C (7), 1-33, doi: 10.3318/PRIAC.2014.114.07.

Galvin, S.A., A.P. Potito and K.R. Hickey (2014) Evaluating the dendroclimatological potential of *Taxus baccata* (yew) in southwest Ireland. *Dendrochronologia* 32: 144-152.

Harrison, S., Rowan, A.V., Glasser, N.F., Knight, J., Plummer, M.A. and Mills, S.C. 2014. Little Ice Age glaciers in Britain: Glacier-climate modelling in the Cairngorm Mountains. *The Holocene*, 24 (2), 135-140.

Knight, J. and Grab, S.W. 2014. Lightning strikes as a geomorphic agent on mountain summits: an example from southern Africa. *Geomorphology*, 204, 61-70.

Knight, J. and Burningham, H. 2014. A paraglacial coastal gravel structure: Connell's Bank, NW Ireland. *Journal of Coastal Research*, Special Issue, 70, 121-126.

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.

Ludlow, F., Adelman, J. and Holm, P. (2013) "Environmental History in Ireland", *Environment and History*, 19 (2), 247-252, doi: 10.3197/096734013X13642082568732

Usoskin, I. G., Kromer, B., Ludlow, F., Beer, J., Friedrich, M., Kovaltsov, G. A., Solanki, S. K. and Wacker, L. (2013) "The AD775 Cosmic Event Revisited: The Sun is to Blame", *Astronomy & Astrophysics*, 553, L3, doi: 10.1051/0004-6361/201321080

Wilson, P. 2014. Cosmogenic isotope surface exposure dating of glacial landforms in Cumbria. *Proceedings, Cumberland Geological Society* 8, 203-232.



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## **10. General Membership Items**

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

### **Join/Renew IQUA membership online via PayPal**

We encourage all our members to update their annual subscription for 2014. 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>

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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.

<i>IQUA membership form</i>
Name: .....
Address: .....
.....
.....
.....
Telephone: .....
E-Mail: .....
Amount paid: .....

If you have any queries about your current IQUA membership status, or general IQUA membership queries, please contact the Treasurer.

**Gayle McGlynn, IQUA Treasurer**

Email: [mcglyng@tcd.ie](mailto:mcglyng@tcd.ie)

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

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### **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](mailto: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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### **IQUA thanks its kind sponsors:**

The CHRONO Centre Queen's University, Belfast  
Ex Libris  
Geological Survey of Ireland