

# IQUA

Cumann Ré Cheathartha na h-Éireann  
**Irish Quaternary Association**  
<http://www.iqua.ie>  
[@Quaternary\\_Irl](#)  
[/IrishQuatAssociation](#)



February 2024

NS: 71

ISSN: 0790-4096

Editor: Susann Stolze

## 1. Editor's Note

Dear IQUA members,

Welcome to IQUA newsletter No. 71.

This issue features abstracts of the IQUA Fall Symposium 2023 and winners of IQUA awards as well as an obituary for Professor Emeritus Mike Ballie who passed away in November 2023. Also included are details of two upcoming IQUA events – the Joint IQUA/QRA Field Meeting to County Louth and the IQUA Spring Meeting 2024.

I would like to thank all who contributed to this edition.

Kind regards,

*Susann Stolze, CSM, Colorado, February 2024*  
 (sstolze@mines.edu)

## 2. Cúpla Focal

[lit.] A couple of words ... from a General Member

Twenty years ago this month I returned from my first field season in the Transantarctic Mountains, my postgraduate mind intoxicated by the wonders of field-based science (glacial geomorphology in this case) under the midnight sun and undiluted by responsibility. Over the intervening decades, even as my responsibilities grew, I gave up trying to explain to the parents how my career choice was not simply an extended holiday. In their eyes, pursuing the Deep Time investigative lifestyle, often at the taxpayer's expense, does not constitute a real job and teaching younger minds to do likewise here in Galway is verging on the reckless. My dad was a solicitor, so perhaps 'real' jobs should be soul-crushing. Parental opinions aside, however, I think that those of us who explore the Quaternary for a living – at universities, government agencies, consultancies, and so on – can readily justify the hours spent dig-

ging into ancient mud, mapping the moraines of glaciers long gone, and chasing insect remains around a petri dish. The reasons stemming from resource management, climate prediction, and geotourism alone are a stone's throw from matters economic and in the Quaternary we have an unrivalled laboratory to work in. My parents won't be convinced, but generally our work is seen as societally valuable.

But what about the wonderment factor? That sense of walking through landscapes that no longer exist, or at least snapshots of time that have long since passed; of learning something exquisite that nobody else has ever known – at least not yet – and in so doing, adding to the vast and ever-growing vault of human knowledge. I know I'm not alone in finding the study of Earth's tumultuous history an effective tonic to the vagaries of modern life, one that provides a comforting affirmation that 'this too shall pass'. As it will. Yet, we don't get so many opportunities to express this aspect to the wider world; without question, my joy is not what funding agencies, industry partners, or anxious stakeholders (I include parents in that category) are in the market to hear! Imagine my delight then to be out yesterday in a rain-soaked forest in County Galway, accompanying a busload of second-year Geography students as they mapped moraines from the last ice age and goaded each other into chiselling pieces off granite erratics for surface-exposure dating. By and large, these 20-year-olds were enjoying themselves: they asked questions that betrayed a desire to unravel the story of these landforms, offered 21<sup>st</sup> century improvements to my antiquated techniques, and understood that by their efforts they were contributing to a genuine scientific investigation. Some were simply content, standing there in the rain, to take intellectual ownership over a small piece of Ireland's Quaternary history, a piece so geomorphically striking it's a wonder that Charlesworth, Ames, or Synge did not map it first. Now it's theirs.

So, the sense of wonder lives on, and we have three students from that class in the lab right now as proof. This isn't part of their BSc curriculum and

won't earn them extra credit, but those three young women are taking the reins in turning the moss-covered rock samples collected yesterday into beryllium-10 ages. Long hours of noisy crushing and tedious chemistry lie ahead, and the resulting data won't change the way the world spins; nor will they be able to explain it satisfactorily to their parents. Nonetheless, those students are fired up about something that happened many millennia ago in a dark corner of Connemara, and I've yet to hear a good reason why that isn't enough.

*Gordon Bromley, IQUA General Member*

---

### **3. IQUA Committee (2024)**

---

**President:** Gill Plunkett, Queen's University Belfast

**Secretary:** Graeme Swindles, Queen's University Belfast

**Treasurer:** Mark Coughlan, iCRAG, University College Dublin

**Postgraduate Rep:** Adrienne Foreman, NUI Galway; Ryan Smazal, Dundalk Institute of Technology

**Webmaster:** Adrienne Foreman, NUI Galway

**Publications Officer:** Mark Coughlan, iCRAG, University College Dublin

**IQUA Newsletter Editor:** Susann Stolze, CSM, Colorado

**General Members:** Gordon Bromley, NUI Galway; Kieran Craven, Maynooth University, GSI; Catherine Dalton, Mary Immaculate College, University of Limerick; Sam Kelley, University College Dublin; Michelle McKeown, University College Cork; Sam Roberson, British Geological Survey, Belfast

---

### **4. IQUA Autumn Symposium 2023**

---

The IQUA Autumn Symposium 2023 was held at the Society House of The Royal Society of Antiquaries of Ireland in Dublin on Friday, 1<sup>st</sup> December 2023. Following the welcome address, the meeting was divided into three sessions addressing 'Marginal environments: processes, use, and resilience'. Announcement of the recipients of the 2023 IQUA awards (see below) and final remarks concluded the symposium. The abstracts are presented below.

### **Environmental aspects of the decline of the ancient Silk Road**

**Kangkang Li<sup>1, 2\*</sup>, Xiaoguang Qin<sup>1</sup>, Gill Plunkett<sup>2</sup>**

<sup>1</sup>Institute of Geology and Geophysics, Chinese Academy of Sciences

<sup>2</sup>Archaeology & Palaeoecology, School of Natural and Built Environment, Queen's University Belfast, Belfast BT7 1NN, United Kingdom

\*Corresponding author: k.li@qub.ac.uk

The ancient Silk Road was of great significance for connections between China and Europe since the second century BCE, facilitating far-reaching, trans-continental exchanges of activities in trade and culture. The UNESCO Silk Roads network is a noteworthy example of current international collaborations on world heritage. Major sections of the Silk Road in northwest China crossed inhospitable areas, including the extremely arid Tarim Basin and the high Inner Asian Mountain Corridor, which are characterised by a complex desert-oasis-alpine-steppe landscape. Since the early 16th century, however, the Silk Road declined substantially, especially the desert routes. Hypotheses regarding the decline of the routeway have tended to take a socioeconomic perspective, considering, for example, the impacts of warfare or the flourishing of the Maritime Silk Road. This paper aims to introduce in brief the ancient Silk Road network and to examine the roles of climatic and environmental factors in its decline.

### **Episodic lateglacial and Holocene meander migration patterns of the Blue Nile River, South Sudan, and their implications**

**Jasper Knight**

School of Geography, Archaeology & Environmental Studies, University of the Witwatersrand, Johannesburg 2050, South Africa

Corresponding author: jasper.knight@wits.ac.za

The Blue Nile River in South Sudan flows northwards across a broad alluvial floodplain from precipitation sources in the Ethiopian Highlands, joining the White Nile River at Khartoum. Here, fluvial sediments have accumulated within a subsiding tectonic basin through the Quaternary. Previous studies in this region have shown significant variations in rainfall and river discharge of the Blue Nile through the lateglacial and Holocene. Other studies have also mapped overview of present and abandoned river channel systems. However, the relative chronology and dynamics of meander migration, and the implications of shifting meanders for patterns of human occupation, have not been investigated. This study maps in detail the spatial patterns of palaeomeanders and cutoffs along a river reach ~100 km in

length in the middle Blue Nile, using remote sensing imagery. The relative timing of abandonment of palaeomeanders and river system dynamics was evaluated based on cross-cutting channel relationships. This also includes reconstructing the directions and rates of meander migration based on patterns of internal scroll bars, and changes in sinuosity. Results show that there is significant spatial and temporal variability in meander patterns, driven by sediment supply and climate. The presence of water is also critical for human activity in this semiarid region: progressive river channel migration influences the development or abandonment of settlements, thus the dated archaeological evidence of floodplain occupation can be used to inform on river system dynamics. This innovative multidisciplinary approach can provide insight into physical and human systems in sensitive semiarid environments during the lateglacial and Holocene.

### **No Man's Land? Can we identify territorial boundaries through pollen analysis?**

**Gill Plunkett**

Archaeology & Palaeoecology, School of Natural and Built Environment, Queen's University Belfast, Belfast BT7 1NN  
Corresponding author: G.Plunkett@qub.ac.uk

Pollen analysis is a well-established method for reconstructing past human activities, and has played a major role in helping to contextualise aspects of the archaeological record. Alternating phases of woodland clearance and regeneration through pre-history and the medieval period point to changing levels of human impact on the environment, much like changing concentrations of radiocarbon-dated archaeological sites reflect periods of greater or lesser human visibility in the past. While it is tempting to correlate such fluctuations with changing population levels, variations in settlement or subsistence patterns could arguably influence the imprint of past societies in the archaeological and palaeoenvironmental records. For instance, with the emergence of complex societies, shifts to a more nucleated settlement pattern could lead to a less extensive archaeological record and woodland regeneration in areas between competing territories, resulting in a net reduction in the visibility of the society of that time. This paper considers the extent to which pollen records can be used to infer the emergence of centralised settlement and the creation of neutral zones between territories, drawing on examples from Late Prehistoric and Early Medieval Ireland.

### **Keynote Talk: Learning from the past? Adapting land use and shaping habitats in uplands since medieval times**

**Eugene Costello**

School of History & Radical Humanities Laboratory, University College Cork  
Department of Archaeology and Classical Studies, Stockholm University  
Corresponding author: ecostello@ucc.ie

This lecture considers why the study of marginal environments in the past offers lessons for us today, particularly in terms of farming and conservation. In the first place, it outlines some of the landscape knowledge and skill that past upland communities had, including how they may have used certain land-use strategies to adapt to climate change. The paper then discusses habitat change and loss over time in uplands and its relevance to present debates about the management of uplands.

### **Socio-political contexts as drivers of upland cultural land-use change and impacts on landscape over the last millennium. The Cabreira Mountain, northwest Portugal**

**Carla Ferreira**<sup>1,2\*</sup>, **Gill Plunkett**<sup>2</sup>, **Luis Fontes**<sup>3</sup>

<sup>1</sup> Maynooth University Department of Geography, Maynooth, Co. Kildare, Ireland

<sup>2</sup> Archaeology & Palaeoecology, School of Natural and Built Environment, Queen's University Belfast, Belfast BT7 1NN, United Kingdom

<sup>3</sup> Landscapes, Heritage and Territory Laboratory Research Unit, Institute of Social Sciences, University of Minho, 4710-057 Braga, Portugal

\* Corresponding author: cferreira01@qub.ac.uk

Mountain landscapes are under threat from climate change, degrading ecosystems and rural exodus, despite a long history of human settlement and exploitation. The present study aims to reconstruct human activity in the Cabreira Mountain, in north-western Portugal, by investigating the degree to which human interaction with the mountain environment has contributed to shifting landscapes and ecosystem demise throughout the last millennium. This study offers a long-term perspective on the evolution of cultural land-use in the context of ongoing social and economic change through the examination of three palaeoenvironmental sequences interpreted in the light of available archaeological, historical, and documentary records. Social-political factors and population pressure were fundamental in the utilisation of upland spaces and in defining the economic structure of the uplands. We conclude that long-term occupation of the uplands was sustained by low-intensity land-use throughout the Me-

dieval to post-Medieval periods, and that the present landscape has assumed a very different character following depopulation of the mountain areas and a shift towards commercial forestry.

### Life on the margin, early people and glacier environments of the Cairngorm

Sam Kelley <sup>1</sup>, Graeme Warren <sup>2\*</sup>, Micheal Butler <sup>2</sup>, Alice Doughty <sup>3</sup>, Martin Moucheron <sup>2</sup>, Nat Lifton <sup>4</sup>

<sup>1</sup> University College Dublin, School of Earth Sciences

<sup>2</sup> University College Dublin, School of Archaeology

<sup>3</sup> University of Maine, School of Earth and Climate Science

<sup>4</sup> Purdue University, Dept. of Geology

\* Corresponding author: graeme.warren@ucd.ie

The Late Glacial and early Holocene climate in Britain was defined by abrupt climate events, such as the Younger Dryas. These variations in climate occurred in tandem dramatic landscape changes driven by the recession of local ice masses. Late Upper Palaeolithic and Mesolithic hunter-gatherers in Northern Britain lived through this period of climatic turmoil, making use of resources available in a rapidly changing environment. Today, upland landscapes continue to be dynamic, with a host of anthropogenic factors, such as reforestation/rewilding, tourism, as well as human-induced climate change driving landscape evolution. Accelerated landscape and environmental change have direct effects on natural and cultural heritage found in upland areas, resulting in poorly understood consequences. This lack of understanding stems from a gap in knowledge regarding the location and extent of heritage in highland areas, specifically that linked to Mesolithic people. The Looking Up project utilizes glacial geology, Quaternary geochronology, and archaeology to generate predictive models of cultural heritage linked to Late Glacial and early Holocene hunter-gatherer use of the Cairngorm region, the highest upland area in Britain and Ireland. Our models, which assess the potential of cultural heritage across a highland landscape, are driven by new deglacial chronologies and glacier modelling as well as existing archaeological and geomorphic datasets. The predictive models are intended as a tool for land managers facing decisions centred on the management of highland landscapes. Here, we show the value of interdisciplinary work in seeking solutions regarding the exploration and preservation of cultural heritage in the Cairngorm.

### Identifying the transition zone between peat and non-peat soils using airborne radiometric data

Dave O'Leary <sup>1,3\*</sup>, J. Connolly <sup>2</sup>, L. Gilet <sup>2</sup>, P. Tuphy <sup>3</sup>, J. Hodgson <sup>4</sup>, E. Daly <sup>1</sup>

<sup>1</sup> HYRES Research Group, School of Natural Sciences, Earth and Life Sciences, College of Science and Engineering, University of Galway, Galway, Ireland

<sup>2</sup> Geography, School of Natural Sciences, Trinity College, Dublin, Ireland

<sup>3</sup> Animal and Grassland Research and Innovation Centre, Teagasc, Moorepark, Fermoy, Co. Cork, Ireland

<sup>4</sup> Geological Survey, Ireland (GSI), Booterstown, Blackrock, Co. Dublin

\* Corresponding author: daveolearyphd@gmail.com

Peatlands play a vital role in carbon storage and climate regulation. However, human activities have exacerbated the fragility of these ecosystems. All landscapes have a physical margin where change between environmental states takes place. However, these margins are rarely well-defined boundaries. Accurate delineation of peat to mineral soil transition zone is critical for assessing land use and planning effective conservation and carbon loss mitigation strategies. This abstract presents a novel approach for defining the transition zone between peat and mineral soils.

Airborne radiometric data, which measures natural environmental radiation, has been shown to differentiate between peat and mineral soils due to high attenuation of gamma rays in peat. This is a result of the high-water content in peat soils. Additionally, as airborne radiometric data is acquired in a spatially consistent manner, it has the potential to identify areas of transition between these soil types.

An updated machine learning methodology, which allows for the extraction of a confidence value, once data are classified as either peat or mineral soil, is presented. The effectiveness of this classification confidence in identifying transition zones is shown at several field sites across the midlands of Ireland, which are located at verified transition zones i.e., around industrial peat extraction land.

The results provide valuable insight for informed land use decisions and mitigation measures in transition zones. Understanding the location of these peat to mineral soil transitions is paramount when considering the impact on climate change mitigation strategies such as potential impact of rewetting of peat soils.

**River channel and floodplains as marginal environments in the Irish landscape: the importance of physical processes and nature based solutions in the restoration of our rivers biodiversity**

**Peter Glanville**

SLR Consulting Ireland Ltd., Dundrum Business Park, Windy Arbour, Dublin 14  
Corresponding author: pglanville@slrconsulting.com

Rivers, including river channels and floodplains, have been a central aspect of the Irish landscape for human activities in terms of society and economic activity. However, in the past c. 150 years changes in economic activity and the implementation of policy measures have meant that our river channels and floodplains have become a marginal environment in the landscape, somewhat forgotten and ‘unloved’.

Government policy measures around our rivers has resulted in the decoupling of river channels from their floodplains to manage the flooding of lands. The control of flooding through intervention measures has resulted in floodplains and associated wetlands becoming a marginal environment.

In order to address biodiversity loss and with the implementation of the new EU Nature Law we need to look carefully at the ecological services that our rivers provide to us as a society. The benefits provided by a functioning river and floodplain system are multi-faceted and include increased biodiversity, climate resilience, flood mitigation and water resilience, all of which provide significant societal benefits.

The Citizens Assembly report on biodiversity loss (March, 2023) made 159 recommendations, 14 of which relate to freshwater environments (rivers and lakes); the government has undertaken a commitment to implement all of the recommendations in the report. Nature Based Solutions offers us a holistic ecosystem-based approach to implementing the report’s recommendations and in particular restoring the natural physical processes of our marginalised river channels and floodplains.

**Exploring the drivers of toxic lake cyanobacterial bloom events using conventional and novel proxies from sedimentary cores**

**David A. Hatton <sup>1\*</sup>, Helen M. Roe <sup>1</sup>, R. Timothy Patterson <sup>2</sup>, Peter R. Leavitt <sup>3</sup>, Ethan T. McCann <sup>4</sup>, David R. McMullin <sup>4</sup>, Eduard G. Reinhardt <sup>5</sup>, Nawaf A. Nasser <sup>2</sup>**

<sup>1</sup> School of Natural and Built Environment, Queen’s University Belfast, BT7 1NN, United Kingdom.

<sup>2</sup> Ottawa-Carleton Geoscience Centre and Department of Earth Sciences, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S5B6, Canada.

<sup>3</sup> Biology Department, University of Regina, Regina, SK, S4S 0A2, Canada.

<sup>4</sup> Department of Chemistry, Carleton University, 1125 Colonel By Drive, K1S 5B6, Ontario, Canada.

<sup>5</sup> School of Geography and Earth Sciences, McMaster University, 1280 Main St. W., Hamilton, Ontario, Canada, L8S 4K1.

\* Corresponding author: dhatton02@qub.ac.uk

Harmful cyanobacterial blooms (CyanoHABs) in freshwater systems have garnered increased public and scientific interest due to the potentially devastating impacts of their toxic secondary metabolites on biota. This has created significant impetus to elucidate the drivers of CyanoHAB occurrence, and to better understand the resilience of lakes to these toxic bloom events.

Dated sediment cores (<sup>210</sup>Pb, <sup>137</sup>Cs, <sup>14</sup>C) from shallow lake sites in New Brunswick, Canada, a maritime region which has seen an increased frequency of lake CyanoHABs in the last decade, have been examined to explore relationships between past toxic bloom events and their controls. Multi-proxy sediment analyses (grain-size, Itrax-XRF; stable isotopes: δ<sup>13</sup>C; δ<sup>15</sup>N) were employed to explore the mechanistic links between the drivers of lake change (i.e. climatological stressors and catchment related disturbances) and past episodes of CyanoHAB development. Cyanobacterial responses were investigated using taxonomically specific sedimentary pigments: aphanizopyll (N<sup>2</sup>-fixing), echinenone (total cyanobacteria), canthaxanthin (nostocales) and myxoxanthophyll (colonial). Microcystin congeners LA, LR, [Dha<sup>7</sup>] LR and RR, cyanobacteria-specific toxic metabolites that preserve in sediments, were quantified using liquid-chromatography tandem mass spectrometry.

Preliminary results show that lake productivity, cyanobacterial pigments and cyanobacteria specific toxins have increased significantly in recent decades across the three lakes studied. Further work is being undertaken to try to elucidate the mechanisms underpinning the drivers of CyanoHAB occurrence in these lakes.

These initial results demonstrate the utility of applying a palaeolimnological approach to reconstructing CyanoHAB events, providing an opportunity to significantly extend the inferences which can be made from water quality monitoring data alone. This may provide invaluable insights into how lakes might respond to future stressors.

## Blind Loughs: a preliminary cartographic and toponymic examination

Catherine Dalton

Mary Immaculate College, University of Limerick, Ireland

\* Corresponding author: Catherine.Dalton@mic.ul.ie

An interesting feature in the landscape depicted on OS maps are 'Blind Loughs' which are found in many counties throughout Ireland. Extinct and extant blind loughs are evident. This talk will examine these cartographic legacies and consider the toponymy of these remnant landscape features. Their role is especially important in the current context of rewetting landscapes and the imperative to enhance carbon sinks.

## Water isotopes across a periglacial Greenland landscape: lessons for paleoclimate reconstruction in Ireland and afar

Pete D. Akers<sup>1\*</sup>, Ben G. Kopec<sup>2</sup>, Eric S. Klein<sup>3</sup>, Jeffrey M. Welker<sup>2,4,5</sup>

<sup>1</sup> Discipline of Geography, School of Natural Sciences, Trinity College Dublin, Dublin, Ireland

<sup>2</sup> Ecology and Genetics Research Unit, University of Oulu, 90014 Oulu, Finland

<sup>3</sup> Department of Geological Sciences, University of Alaska Anchorage, Anchorage, AK, USA

<sup>4</sup> Department of Biological Sciences, University of Alaska Anchorage, Anchorage, AK, USA

<sup>5</sup> University of the Arctic (UARctic), c/o University of Lapland, 96101 Rovaniemi, Finland

\* Corresponding author: pete.akers@tcd.ie

Periglacial landscapes in Greenland occupy the marginal transition from the extreme environment of the Greenland ice sheet and the relatively hospitable environment of the oceanic coast. Every summer, the ice-free tundra fringing the ice sheet briefly comes alive as lakes, streams, and the uppermost soil thaw, but rapidly changing Arctic climate is disrupting these surface water systems. To improve our interpretation of stable water isotopes in periglacial environments, we collected 535 surface water samples in 2018–2019 across the Pituffik Peninsula in far northwest Greenland. The  $\delta^{18}\text{O}$ ,  $\delta^2\text{H}$ , and deuterium-excess values of these samples, representing 196 unique sites, reveal great isotopic diversity at small spatiotemporal scales, and this grants us unprecedented insight into the environmental drivers of the region's hydrology. Isotopic variability of lakes is dominated by evaporation, while stream isotopic composition is determined by relative contributions from the ice sheet, tundra snowpack, and lakes. Summer precipitation has a much weaker influence on surface water isotopic composition than typically assumed, and regional

climate reconstructions based on that assumption likely require re-evaluation. For Irish paleoclimate reconstructions using water stable isotopes, this study reminds us of the importance of local isotopic monitoring and the risks of assuming that isotope-climate relationships determined for one water body are representative of all water bodies in the region. This is particularly true for Irish lake isotopic records from the late Pleistocene and early Holocene, when the deglaciating Irish landscape bore many similarities to the modern Greenland periglacial environment that we report on here.

## Holocene oceanographic change in northwest Greenland

Matthew Hunt<sup>1\*</sup>, Andrew Newton<sup>1</sup>, Brice Rea<sup>2</sup>, Anne Jennings<sup>3</sup>

<sup>1</sup> Geography, School of Natural and Built Environment, Queen's University Belfast, Belfast, BT7 1NN, UK

<sup>2</sup> School of Geosciences, University of Aberdeen, Aberdeen, UK

<sup>3</sup> University of Colorado Boulder, INSTAAR/Department of Geological Sciences, Boulder, CO, USA

\* Corresponding author: mhunt12@qub.ac.uk

A full understanding of past Greenland Ice Sheet (GrIS) dynamics in response to climate change is key to modelling and projecting future oceanographic and climatic scenarios. Outside of the Disko Bugt region of West Greenland there is a less well developed understanding of the timing and dynamics of the most recent deglaciation following the Last Glacial Maximum (LGM). For example, the seafloor of the Melville Bugt Trough (MBT) to the northwest of Disko Bugt has only recently been mapped and shows that ice reached the shelf edge at the LGM, making it ~80 km more advanced than previously thought (Newton et al., 2017). If the MBT was fully occupied by an ice stream at the LGM, as suggested by seafloor landforms, it would have drained an area of the GrIS at least three times larger than Jakobshavn Isbræ, highlighting the need for a better understanding of its post-LGM evolution. The narrowest portion of MBT hosts a large grounding-zone wedge which has been tentatively correlated with an ice-stream stillstand during the Younger Dryas. Sedimentological evidence from shallow sediment cores collected on the grounding-zone wedge surface provide information about the ice stream's subsequent retreat and prevailing palaeoceanographic conditions during the Holocene.

## New investigations into the deglaciation of northeast Ireland: initial results from high-resolution geomorphological mapping

Alex Clark<sup>1,2\*</sup>, Sam Roberson<sup>3</sup>, Bethan Davies<sup>4</sup>, Simon Blockley<sup>1</sup>, Adrian Palmer<sup>1</sup>, Magret Damaschke<sup>2</sup>

<sup>1</sup> Department of Geography, Royal Holloway University of London, Egham, Surrey TW20 0EX

<sup>2</sup> British Geological Survey, Keyworth, Nottinghamshire NG12 5GG

<sup>3</sup> Geological Survey of Northern Ireland, Belfast BT4 3SB

<sup>4</sup> School of Geography, Politics and Sociology, Newcastle University, Newcastle-Upon-Tyne, Tyne and Wear NE7 7RU

\* Corresponding author: alexander.clark.2015@live.rhul.ac.uk

Rapid shutdown of the Irish Sea and Malin Sea Ice Streams c. 23-17 ka BP led to the decay of ice centres in northeast Ireland, punctuated by brief readvances in cold climate periods, eventually culminating in the separation of Irish and British Ice Sheets. This region therefore provides an excellent opportunity to study the interplay of internal ice dynamics and rapid climate change during deglaciation at the centre of the last British-Irish Ice Sheet.

However, our understanding of the retreat of a Lough Neagh ice centre, the unzipping of the British and Irish Ice Sheets, and the readvance of Scottish ice in northeast Ireland is founded on low-resolution geomorphological maps and very little chronological information. Our project aims to remedy this using high-resolution geomorphological maps to better understand ice sheet dynamics, combined with a novel multiproxy chronological approach to robustly anchor key ice flow phases for the first time.

Here we present initial results and interpretations derived from the mapping of >11,000 glacial landforms in northeast Ireland using a 40 cm resolution digital surface model. We argue that the demise of a Lough Neagh ice centre was potentially characterised by a transition from ice streaming conditions to a rapid time-transgressive style of retreat influenced by bed topography. Other bedforms and deglacial features reveal additional complexity in the nature of ice sheet readvance onto the Antrim coast. Cosmogenic nuclide ages and a laminated palaeolake sequence are being sought for the first time to constrain the timing of these significant events.

---

## 5. IQUA Award Winners 2023

---

### Valerie Hall Award

#### Helen Essell

Queen's University Belfast, UK

Helen received the Valerie Hall Award for the best student or early-career researcher-led paper published by an IQUA member for her paper "A frequency-optimized temperature record for the Holo-

cene" published in *Environmental Research Letters* in 2023 (DOI 10.1088/1748-9326/ad0065).

### Abstract

Existing global mean surface temperature reconstructions for the Holocene lack high-frequency variability that is essential for contextualising recent trends and extremes in the Earth's climate system. Here, we isolate and recombine archive-specific climate signals to generate a frequency-optimised record of interannual to multi-millennial temperature changes for the past 12 000 years. Average temperatures before ~8000 years BP and after ~4000 years BP were 0.26 ( $\pm 2.84$ ) °C and 0.07 ( $\pm 2.11$ ) °C cooler than the long-term mean (0–12 000 years BP), while the Holocene Climate Optimum ~7000–4000 years BP was 0.40 ( $\pm 1.86$ ) °C warmer. Biased towards Northern Hemisphere summer temperatures, our multi-proxy record captures the spectral properties of transient Earth system model simulations for the same spatial and season domain. The new frequency-optimised trajectory emphasises the importance and complex interplay of natural climate forcing factors throughout the Holocene, with an approximation of the full range of past temperature changes providing novel insights for policymakers addressing the risks of recent anthropogenic warming.

### Bill Watts Award

#### Alex Clark

Royal Holloway, University of London, UK

As a postgraduate IQUA member, Alex was bestowed with the prestigious Bill Watts Award. His research combines radiocarbon dating, tephrochronology, and varve chronology from Cannons Lough to constrain the retreat of Lough Neagh ice by providing a precise minimum age for the inception of glaciolacustrine conditions after this extensive ice mass retreated. The award will be used for radiocarbon dating which will be combined with cosmogenic nuclide constraints to produce a regional deglaciation chronology.

### IQUA Research Awards

#### Sarah Ferrandin

Queen's University Belfast, UK

Sarah's research sets out to investigate the theory by Guiry et al. (2018) that there was an anthropologically driven shift in the terrestrial nitrogen cycle during the Irish Bronze Age, resulting from a widespread intensification of agriculture. Sarah will use

the award for the use of the electron microprobe at Queen's University Belfast to analyse the major element geochemical composition of the tephras.

**Graeme Warren**

University College Dublin

Graeme was received funding for radiocarbon dates to support analysis of a palaeoenvironmental (peat) sequence in a river channel which has partially eroded a Mesolithic site in the high Cairngorm mountains, Scotland. This will provide dating evidence for the site itself, and a framework for palaeoenvironmental reconstruction. This is part of a long-term project on the Late Glacial/Early Holocene hunter-gatherer use of mountain landscapes which is providing new information about a poorly understood area.

---

**6. IQUA Spring Meeting 2024**

---

The IQUA Spring Meeting 2024 and AGM will be held at the University of Ulster on 27 April 2024. A call for abstracts will be issued shortly. Postgraduate research students are especially encouraged to present their projects at this meeting.

*Gill Plunkett, Queen's University Belfast*

---

**7. IQUA Field Meeting 2024**

---

**County Louth**

This year's joint IQUA/QRA field meeting will take place on 5-7 April 2024 in Co. Louth, a small county with a rich and diverse heritage that punches above its weight. The meeting will commence at 7 pm with an introductory talk and social evening in the Copper Room, the Imperial Hotel, Dundalk. For early birds who can make it to Dundalk on Friday afternoon, there will be an optional extra in the form of a Walking Tour of Dundalk. On Saturday and Sunday, we will be visiting a range of glacial, palaeoecological, archaeological and heritage sites. Saturday's excursion will take us along the Louth coast, into the southern reaches of the county. Sunday's trip will focus on sites around Cooley Peninsula, with a view to returning to Dundalk by mid-afternoon. We expect to arrange transport for participants, but costs are still being worked out and details will be circulated via the IQUA/QRA email lists in the coming weeks.

Note that the Imperial Hotel is offering rooms at €386 for a two-night stay with bed & breakfast based on single occupancy, and the Gateway gave us prices (including breakfast) of €155 per night for a single Room and €165 for a double/twin room. Not so very different to what you can find on their websites, so shop around!

Please send queries and expressions of interest to Gill Plunkett (g.plunkett@qub.ac.uk).

*Gill Plunkett, Ryan Smazal, Jasper Knight and Cathy Delaney*

---

**8. IQUA Award Announcements 2024**

---

**Eileen Reilly Postgraduate Research Award**

The Eileen Reilly Postgraduate Research Award is now open for submissions. The deadline is 1<sup>st</sup> March 2024 (5 pm). Please send application forms directly to G. Swindles (g.swindles@qub.ac.uk). Forms are available on the IQUA website. Please note that if this award is to be used to purchase radiocarbon dates these should preferably be carried out at <sup>14</sup>Chrono Centre at Queen's University Belfast.

IQUA proudly sponsors the Eileen Reilly Postgraduate Research Award, in memory of Eileen Reilly, an active member of IQUA who passed away in 2018.

The award consists of one grant of €500 to be used for either conference attendance, a training course, fieldwork or laboratory analysis by one of our postgraduate members. The award recipient will describe their research and the use of the award in the IQUA Newsletter.

Applicants must be working towards a Master's or PhD degree and be a paid up member of IQUA for a minimum of six months when the application is made.

---

**9. Recent Graduates**

---

**Marie-Therese Barrett**

Queen's University, Belfast  
PhD defended in June 2023

**Drumclay: a tree-ring dated narrative for an Irish crannog**



Tree-ring chronologies provide unparalleled resolution for archaeological sites. Dendrochronology can give an exact calendrical date, and in Britain and Ireland this is largely confined to oaks and pines. Other species such as black alder (*Alnus glutinosa* (L.) Gaertn.) are often preserved in waterlogged conditions, but are less commonly used to construct chronologies. Alder is a short-lived species with a growth pattern that is highly susceptible to local environmental factors. For this reason it is not suitable for traditional dendrochronology. Tree-ring analysis of alder assemblages can, however, produce valuable relative chronologies that can be anchored to a timeline using  $^{14}\text{C}$  dating and wiggle-match age-modelling. This project aims to establish if tree-ring analysis of alder samples from an early medieval crannog (Drumclay, Co. Fermanagh) could be used to develop an annually resolved narrative of site construction, occupation and abandonment, and to shed light on early medieval settlement in Ireland more generally. Visual and statistical cross-correlation of multiple radii from 834 samples was undertaken to construct tree-ring sequences from individual trees, contexts and features, culminating in a master alder chronology spanning 116 years. The results demonstrate that a robust annual chronology can be created from alder samples providing that a large assemblage exists that can withstand the rejection of spurious ring patterns arising from sample-specific issues. Identification of the AD 774/775  $^{14}\text{C}$  anomaly within the sequence has anchored the relative chronology to a yearly calendrical timeline. The chronology reveals that the site was first constructed in AD 811 and allows the subsequent expansion and development of the site to be tracked on a year-by-year basis over a 30-year period. Significantly, the precision of the alder chronology has enabled a comparison of the narrative of this site with both historical and environmental records at an annual resolution. The alder chronology highlights the rapid replacement of dwellings at 1-10 year intervals at Drumclay, which has implications for estimates of structure and site longevity at other early medieval sites in Ireland. The chronology also enables validation and refinement of previously proposed chronologies for a range of artefact typologies. An oak chronology for the upper levels of the site reveals that the transition from round to rectangular houses at Drumclay occurred in the later 10th century. The study demonstrates the feasibility of constructing a refined chronology for wetland sites using short-lived trees, and shows how tree-ring analysis can provide more comprehensive insights into early medieval settlement.

---

## 10. Obituary

---

### Mike Baillie (1944–2023)

Queen's University Belfast



Prof. Emeritus Mike Baillie, one of Ireland's Quaternary giants, passed away on 13 November after a period of illness, a couple of days short of his 79<sup>th</sup> birthday. Mike was a man of many talents, but was world-renowned as a dendrochronologist, a career he built after a less-than-promising start as a Physics undergraduate. He was instrumental in the establishment of the Belfast oak chronology in the 1970s, one of the world's earliest long tree-ring records that underpinned the first international radiocarbon calibration curve published in 1986. Mike's work was not restricted to chronology construction, however, as he found ample applications for it, from the dating of archaeological sites and phases of building activity (or lack of building) to the re-dating of art-historical timbers, and most notably, the recognition of growth anomalies that signalled short, sharp shocks to the trees' growing conditions. Quick to join the dots, Mike soon noticed that the trees in Ireland were experiencing these events at the same time as trees in Germany and North America, and that their timing coincided with large volcanic sulphate anomalies in Greenland ice cores. He proposed a volcanic cause for the growth anomalies and extrapolated that any climate response that was that bad for trees was probably also bad for societies at the time (or specifically, for their crops and livestock). It was around this time that I first came to know Mike, when I joined Queen's as a master's student in 1994. Almost from the start, we debated whether cultural changes were a direct response to climate changes or the culmination of more complex societal issues and processes, but Mike would en-

courage me to prove him wrong so that science could move forward. Indeed, he strongly advised against letting one's ego, one's weddedness to a particular perspective, get in the way of accepting new science. He was also not afraid to go out on a limb with new ideas, and some considered his theories on cosmic impacts (an alternative explanation for the growth anomalies in trees) as fringe science. But Mike was meticulous in pulling together information from many disciplines, and he wove together narratives that were both thought-provoking and accessible, and quite probably contained at least a nugget of truth.

Even after his retirement, Mike was part of the fabric of Archaeology-Palaeoecology at Queen's up until COVID confined us all to our homes. Coffee-time was never dull when Mike was in, and Fridays were guaranteed to see him arrive in with little oddities freshly procured from the antiques market (one of his other talents was an eye for curios of value). He was generous, he was witty, he was highly cynical in the most entertaining way, and he managed to be simultaneously pessimistic about and amused by humankind's follies. Mike had more theories to offer, more stories to tell, and I hope his more recent endeavours may yet come to be published.

Mike is hugely missed by all in ArcPal at Queen's. Our thoughts are with his wife Deborah, his daughters Caroline and Juliet, and the wider family.

Gill Plunkett, Queen's University Belfast

---

## 11. Recent Publications

---

Andreoli, M.A.G., Knight, J., Durrheim, R.J., Evans, M. 2023. The geomorphology and neotectonics of the Vaalputs Radioactive Waste Disposal Facility site, Namaqualand, South Africa: Palaeoseismological and geodynamic implications. *South African Journal of Geology* 126, 485–514.

Bangelesa, F., Abel, D., Pollinger, F., Rai, P., Ziegler, K., Ebengo, D., Tshimanga, R.M., Mapatano, M.A., Knight, J., Paeth, H. 2023. Projected changes in rainfall amount and distribution in the Democratic Republic of Congo – evidence from an ensemble of high-resolution climate simulations. *Weather and Climate Extremes* 42, 100620.

Habib, W., Connolly, J. 2023. A national-scale assessment of land use change in peatlands between 1989 and 2020 using Landsat data and Google Earth Engine—a case study of Ireland. *Regional Environmental Change* 23, 124.

Habib, W., Ingle, R., Saunders, M., Connolly, J. 2024. Quantifying peatland land use and CO<sub>2</sub> emissions in Irish raised bogs: mapping insights using Sentinel-2 data and Google Earth Engine. *Scientific Reports* 14, 1171.

Hassan, B.A., Knight, J. 2023. Adaptation to climate change and variability by farming households in north-central Nigeria. *Sustainability* 15, 16309.

Essell, H., Krusic, P.J., Esper, J., Wagner, S., Brannon, P., Jungclaus, J., Muschitiello, F., Oppenheimer, C., Büntgen, U. 2023. A frequency-optimized temperature record for the Holocene. *Environmental Research Letters* 18, 114022.

Knight, J., Burningham, H., Griffiths, D., Yao, Y. 2023. Coastal boulder movement on a rocky shoreline in northwest Ireland from repeat UAV surveys using Structure from Motion photogrammetry. *Geomorphology* 440, 108883.

Knight, J., Merlo, S., Zerboni, A. (eds.) 2024. Landscapes and Landforms of the Central Sahara. Springer Cham, 235 pp.

Lembani, R., Knight, J. 2023. Factors controlling soil organic matter stock: A baseline study for evaluating carbon storage initiatives in Miombo woodlands, Zambia. *Communication in Soil Science and Plant Analysis* 54, 2189–2204.

Ngobeni, D., Knight, J. 2023. Evaluation of river mouth dynamics along the Eastern Cape coastline, South Africa. *Transactions of the Royal Society of South Africa* 78, 167–180.

Plunkett, G. 2023. Environmental history of the Ballynahatty area. In: Hartwell, B., Gormley, S., Brogan, C., Malone C. (eds.) Ballynahatty: Excavations in a Neolithic Monumental Landscape. Oxbow, Oxford, pp. 28–30.

Smith, A., Wilson, P. 2023. Quaternary events, processes and landforms. In: Wrigley, R. (ed.) *Geology of Cumbria (Volume 1: Cumberland)*. Geologists' Association Guide No. 77, The Geologists' Association, London, pp. 21–34.

Wilson, P., Smith, A. 2023. Quaternary landforms of upper Borrowdale. In: Wrigley, R. (ed.) *Geology of Cumbria (Volume 1: Cumberland)*. Geologists' Association Guide No. 77, The Geologists' Association, London, pp. 139–154.

Wilson, P., Jarman, D. 2023. Relict rock slope failures in the upper Buttermere valley. In: Wrigley, R. (ed.) *Geology of Cumbria (Volume 1: Cumberland)*. Geologists' Association Guide No. 77, The Geologists' Association, London, pp. 155–169.

Wilson, P., Jarman, D., Miguens-Rodriguez, M., Fabel, D. 2023. Cosmogenic ( $^{10}\text{Be}$ ) surface-exposure ages from the Burtness Comb rock avalanche, Lake District, northwest England. *Proceedings of the Geologists' Association* 134, 619–626.

---

**IQUA Membership Form**

---

Please let your students and colleagues know about IQUA and encourage them to join. Join or renew IQUA membership online via PayPal. We encourage all our members to update their annual subscription for 2024. If you have any queries about your current IQUA membership status, or general IQUA membership queries, please contact the IQUA Treasurer Mark Coughlan ([mark.coughlan@icrag-centre.org](mailto:mark.coughlan@icrag-centre.org)).

The annual membership cost is: €25 waged; €15 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, please complete the following form and send it with a cheque for the relevant annual subscription to the IQUA Treasurer Mark Coughlan at the address below. Cheques should be made payable to IQUA.

Mark Coughlan  
iCRAG (Irish Centre for Research in Applied Geosciences)  
O'Brien Centre for Science (East)  
University College Dublin  
Belfield  
Dublin 4  
Ireland

Name: .....

Address: .....

.....

.....

.....

Telephone: .....

E-Mail: .....

New Membership:

Renewal:

Total amount enclosed: .....

Thank you to our sponsors!



**Geological Survey**  
Suirbhéireacht Gheolaíochta  
Ireland | Éireann

**ARUP**



**UCD School of Archaeology**



# Queen's University Belfast AMS Radiocarbon Dating

...over 45 years  
of experience...



- ✓ newly installed MICADAS AMS system
- ✓ results: - typically less than 8 weeks
  - fast track available
  - accurate and precise
  - $^{13}\text{C}$  &  $^{15}\text{N}$  included for bones
- ✓ small sample size
- ✓ full sample pretreatment (all types)
- ✓ expert sampling and calibration advice
- ✓ 10% student discount (10 max)

Contact us for current price and turnaround:  
<http://14chrono.org>      [chrono14@qub.ac.uk](mailto:chrono14@qub.ac.uk)  
+44 (0)28 9097 3104