IQUA
Irish Quaternary Association
Cumann Ré Cheathartha na h-Éireann

2025 Irish Quaternary Association (IQUA) Spring Meeting

Department of Geography Mary Immaculate College, Limerick

29th March 2025

Tara Bldg. Rm. T116

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2025 IQUA Spring Meeting

Mary Immaculate College, Limerick

Symposium PROGRAMME

09.30+ Registration

10.40- 11.00 **Andrew Tighe:** Ancient sedimentary DNA reveals a more biodiverse ancient Ireland

11.00-11.20 **Alex Clarke:** Investigating a new Late Glacial tephrostratigraphy and varve chronology at Cannons Lough, Northern Ireland

11.20-11.40 **Sinéad Flanigan:** Using the tephra record to refine the dating of a west Antarctic ice-core

11.40-12.00 **Leanne O'Donoghue:** Microbial Diversity in Tropical Peatlands of the South Pacific - Linking past and present

12.00-12.20 **Michael O'Connell:** Holocene flora, vegetation and land-use on the Dingle peninsula: what fossil pollen data tell us

12.30-14.00 Lunch

14.00-14.20 **Xyza Vasily Dela Peña:** Methodological Advances to Trace Past CH4 (MATCH4)

14.20-14.40 **Nick Scroxton (+):** First Harvests: Climate, Chronology and Cereal in the Neolithic

14.40-15.00 **Pete Coxon:** Rock slope failures: two examples from the Twelve Bens and Maumturks, Co. Galway

15.00-15.20 **Michael Guilfoyle:** Boots, crampons, polkas and imagination over icy places

15.30 **IQUA AGM**

Ancient sedimentary DNA reveals a more biodiverse ancient Ireland

Andrew Tighe

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The island of Ireland has been highlighted as one of the most nature depleted areas on Earth, however it has significant potential for largescale nature restoration. However, there remains uncertainty around which species naturally colonized Ireland after the last glacial maximum period, particularly large herbivores. This study reports an ancient sedimentary DNA record from the Mesolithic in Ireland (10,000 years ago) up to the present day, from a lake core taken at Lough Feeagh, in the West of Ireland. The plant DNA results reveal a changing landscape, with hazel and oak being dominant in the early Holocene, with the highest diversity of tree species in the Bronze age, and also builds on previous work suggesting hornbeam may be a native tree. The mammalian DNA detected confirms many known Irish species such as red deer, wild boar and wood mouse, and suggests the later survival of some arctic fauna into the Holocene, namely reindeer and arctic fox. It also suggests the possible presence of aurochs in early Holocene Ireland. Aurochs were keystone species in ancient Europe, but definitive evidence of their presence in Ireland has previously been lacking. Additionally, the DNA record for fish confirms a number of known species, such as Atlantic salmon and stickleback, but also suggests that pike may have been in Ireland earlier than conventionally accepted. These findings open up new possibilities for the restoration of nature in Ireland, revealing a more biodiverse baseline for restoration efforts to benchmark against.

A new Late Glacial varve chronology and tephrostratigraphy at Cannons Lough, Northern Ireland: Implications for the timing of deglaciation in northeast Ireland

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Ages pinpointing the timing of deglaciation in the northeast of Ireland are sparse and typically only constrain the initiation of organic sedimentation in lake basins well after the landscape becomes ice-free. Consequently, our understanding of the timescales of large ice centre collapse over the north of Ireland is fraught with uncertainty, meaning few insights can be gleaned into how the last British-Irish Ice Sheet (BIIS) behaved as it approached complete demise during the Late Glacial (*c.* 18-15 ka BP).

This talk outlines our efforts to remedy this by providing a new, accurate and precise constraint on deglaciation in northeast Ireland using a novel multi-chronological approach. Newly discovered annually laminated (varved) sediments extracted from Cannons Lough (Co. Londonderry) in the Lower Bann valley were used to produce a detailed varve chronology spanning a period of ice-contact lake development during deglaciation. A new tephrostratigraphy comprising multiple Late Glacial cryptotephra horizons, alongside preliminary radiocarbon dates of macrofossils and sediments are being employed to help anchor this floating chronology through age-depth modelling.

A tentative age for the initiation of ice-proximal (sub-aerial) glaciolacustrine conditions in the Lower Bann valley of *c.* 15.9-16.2 ka BP is presented. Our results provide unprecedented accuracy on the timing of deglaciation over northeast Ireland compared to previous studies using radiocarbon dating alone, though efforts to improve its precision are still ongoing. This preliminary constraint aligns well with earlier estimates suggesting a mid-Heinrich Stadial 1 age for the deglaciation of the northeast Irish lowlands, but is discordant with constraints obtained from state-of-the-art BIIS models.

Using the tephra record to refine the dating of a west Antarctic ice-core

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The paleoenvironmental records that ice cores provide have globally significant applications. In particular, ice cores contain highly resolved archives of short-term environmental events that are key to our understanding of Earth systems. To gain a thorough understanding of these events, a reliable and accurate chronology must be constructed. This can be complicated by compression and ice-flow processes, which may result in large uncertainties in the timing of events. Volcanic signals preserved in the ice are an established method of creating tie-points between ice cores, enabling more robust dating of cores that can be applied to less well dated records. Sulphur spikes are used as indicators of a volcanic event; however, long-lasting spikes and lag times between an event and deposition can impact the accuracy of tie-points. To reduce these uncertainties, tephra deposits can be used to provide age-equivalent and independently dated linkages.

This study investigates the tephra record of the 654 m-long Fletcher Ice Core (FIC) drilled by British Antarctic Survey. Initial analysis indicates that the FIC extends back to ~130 ka with confident dating of the last 3500 years through the use of cross-dating with chemical data from the West Antarctic Ice Sheet (WAIS) Divide ice core. We target key volcanic events with known deposits in Antarctica, aiming to (i) corroborate and improve upon the dating of the Holocene ice and (ii) establish key tie-points in the Late Glacial ice. Here we outline the progress so far, initial results and the significance of this tephrochronological investigation.

Microbial Diversity in Tropical Peatlands of the South Pacific - Linking past and present

Leanne O'Donoghue

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Tropical peatlands are essential in the global carbon cycle, with an estimated 40-90 Gt of carbon being stored in peat (Kurnianto et al., 2014). Some of the most carbon-dense peatlands exist in the tropics (Bandla et al., 2019). Despite their critical role in carbon storage and ecosystem functioning, tropical peatlands remain vastly understudied, particularly in the South Pacific. Furthermore, microbial diversity is poorly understood in most peatlands worldwide (Liu et al., 2019). The overarching goal of the HUMID project is to increase our scientific understanding of microbial diversity in two tropical peatlands in the South Pacific region (Fiji and Uvea). We aim to integrate DNA-based techniques including RAPD (Random Amplified Polymorphic DNA) and Biolog assays, alongside testate amoebae analysis (keystone microbial species) using microscopy. By combining molecular and morphological approaches, this study seeks to characterise microbial community composition, functional diversity, and ecological interactions in peatland ecosystems alongside water table depth and pH. This will allow us to identify the dominant environmental controls that drive changes in microbial community structure and to explore spatial and temporal microbial turnover and assemblage patterns at Lac Lanutule (Uvea) and Lake Tagimaucia (Fiji). Furthermore, we will assess functional traits in modern testate amoebae and prokaryotic communities to establish ecological linkages between these microbial groups (Barrett et al., 2021). By identifying correlations between microbial functional diversity and environmental variables, we aim to determine whether contemporary microbial dynamics can serve as analogues for past conditions. This knowledge will be used to develop an inference model that reconstructs past hydrological changes through testate amoebae assemblages, providing a framework for linking past environmental shifts to microbial responses over time.

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Barrett, K.D., Sanford, P. & Hotchkiss, S.C. The ecology of testate amoebae and Cladocera in Hawaiian montane peatlands and development of a hydrological transfer function. *J Paleolimnol* **66**, 83–101 (2021).

Holocene flora, vegetation and land-use on the Dingle peninsula: what fossil pollen data tell us

Michael O'Connell

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Dingle (*Corca Dhuibhne* in Irish), the northernmost of the three great peninsulas that define the coastline of south-west Ireland, is characterised by uplands that run for much of the length of the peninsula to reach 951 m in Mount Brandon near the western end. The bedrock consists mainly of Devonian sandstones. As in the west Cork/Kerry region generally, the uplands in particular have been moulded by ice sheets dating to the last glaciation. Today, blanket bog covers the uplands while the lowlands have a rich archaeology that spans most of prehistory and historical times (Cuppage 1988).

The impetus for this presentation comes from palaeoecological investigations by Steffen Wolters in the early 1990s in Kilmore townland. These were written up as a MSc thesis (Wolters 1996). The study area, Kilmore, was selected on account of the extensive pre-bog, stone-wall systems that were being mapped at the time by Mícheál Ó Coileáin (2003, 2012). From the same general area, i.e. Lough Adoon/Lough Camclaun, there are detailed investigations by Dodson (1990a, b), while, from the western side of the Brandon mountain range, Barnosky (1988) has a long lake-sediment pollen profile (Ballinloghig) that spans the Lateglacial and Holocene. The data available from these studies have now been replotted and new insights obtained into long-term Holocene environmental change at fine spatial and temporal scales.

Barnosky, C.W. (1988) A late-glacial and post-glacial pollen record from Dingle Peninsula, County Kerry. *Proceedings of the Royal Irish Academy, Sect. B,* 88B, 23–37.

Cuppage, J. (1986) *The archaeological survey of the Dingle peninsula*. Oidhreacht Chorca Dhuibhne, Ballyferriter.

Dodson, J.R. (1990a) The Holocene vegetation of a prehistorically inhabited valley, Dingle peninsula, Co. Kerry. *Proceedings of the Royal Irish Academy, Sect. B,* 90B, 151–174.

Dodson, J.R. (1990b) Fine resolution pollen analysis of vegetation history in the Lough Adoon Valley, Co Kerry, western Ireland. *Review of Palaeobotany and Palynology,* 64, 235–245.

Ó Coileáin, M. (2003) *The archaeology of the Loch a'Duin Valley, Cloghane, Co. Kerry*. MA thesis (unpublished). Department of Archaeology, NUI Galway [University of Galway], Galway.

Ó Coileáin, M. (2012) The archaeology of the Loch a'Dúin valley. *The Kerry Magazine***,** 44–45.

Wolters, S. (1996) *Pollen analytical investigations towards the reconstruction of late Holocene environmental change in Kilmore Td., Corca Dhuibhne, Co. Kerry*. M.Sc. thesis (unpublished), Department of Botany, NUI Galway [University of Galway], Galway.

Methodological Advances to Trace Past CH4 (MATCH4)

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Although peatlands are well-known as carbon sinks, their influence on atmospheric methane (CH_4) concentrations remains poorly understood on long-term timescales. As CH_4 is a potent greenhouse gas, with a warming capacity 28–36 times that of carbon dioxide, it is a significant contributor to climate change (IPCC, 2023; Neubauer, 2021). While there has been notable progress in our understanding of net ecosystem exchange of GHG from peatlands (Hambley et al., 2019; Lees et al., 2019; Premrov et al., 2021), knowledge gaps still exist in our understanding of long-term CH_4 emissions. Palaeo-methane reconstructions are regionally poorly constrained outside of the well- known and globally important ice core records (Blunier et al., 1995). Although attempts have been made internationally to improve our understanding of long-term CH_4 emissions, through building transfer functions using peatland vegetation assemblages (Mathijssen et al., 2017) and lipid biomarkers from microbial communities involved in methanogenesis (Zheng et al., 2019), they have been met with various challenges. Testate amoebae have been used to infer palaeo-CH_4 by applying a linear regression models derived from contemporary growing season methane fluxes and WTDs (Davies et al., 2021). Frésard et al. (2023) further highlights the promising potential of testate amoebae for inferring northern hemisphere peatland methane through direct measurements with this gas. Our study builds on this pioneering work and aims to develop a TA-based inference model to directly reconstruct long-term CH_4 fluxes in Clara Bog in Ireland and test the validity of the inference model by applying it to sub-fossil testate amoebae assemblages extracted from a 2-metre core. Preliminary results show promising potential of testate amoebae to infer palaeo-methane reconstructions in Ireland.

Blunier, T., Chappellaz, J., Schwander, J., Stauffer, B., & Raynaud, D. (1995). Variations in atmospheric methane concentration during the Holocene epoch. *Nature*, *374*, 46–49. https://doi.org/10.1038/374046a0

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First Harvests: Climate, Chronology and Cereal in the Neolithic

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The introduction of farming and associated cultural practices in Ireland was relatively rapid, occurring over just a century or two between 4000-3800BC in the Early Neolithic. However, following an early widespread uptake there is a marked reduction in the frequency of cereals recovered from archaeological sites between 3400-2500 BC during the Middle and Late Neolithic. Does this drop in signal indicate a shift away from arable agriculture? Or does it reflect a bias in sample visibility and retrieval? Not only has there been less research into the 'post- pioneer' phase of agriculture, but archaeological evidence itself is difficult to detect with settlement evidence post-3600 BC much more ephemeral and ambiguous. Further, what role might climate play in changes in subsistence strategy and/or cultural changes that drive the perceived drop? Did abrupt climate change events such as at 5.2 ka (3300-3100 BC) impact Irish climate and drive societal change? Or are there longer, lower frequency changes in temperature, rainfall amounts and/or seasonality? Finally, can we integrate climatic and archaeological data to provide context for societal change, while recognising the limitations and pitfalls of climate determinism.

In this talk we introduce the First Harvests project. First Harvests is a Research Ireland Coalesce interdisciplinary project between the Schools of Archaeology and Earth Sciences at UCD investigating the archaeobotany and paleoclimatology of this crucial period of Ireland's earliest farming story. The aim is to understand the interaction between changing climates and farming strategies in prehistoric Ireland, to fill a crucial knowledge gap in the development of cereal agriculture. The project will involve assessing existing material and records of past archaeological, climatic and environmental change, and produce new archaeobotanical data of changing cereal practices and speleothem trace element records of changing climate variability. First Harvests offers exciting new potential to explore and better understand prehistoric farming systems and deep-time human environment interactions, dramatically improving our understanding of Neolithic lifeways and social change in northwest Atlantic Europe.

Rock slope failures: two examples from the Twelve Bens and Maumturks, Co. Galway

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Large Rock Slope Failures (RSF) are common in paraglacial and formerly glaciated terrains where they form major geomorphological features that encompass rock slides, rock avalanches and rock deformation. The types of failure can be characterised as being caused by plane sliding (including rotational slides), wedge sliding and toppling -all of which may be localised or can result in redistribution of disaggregated rock debris (as run-out material contained within rock debris avalanches).

The scale and ubiquity of RSF in the upland landscape of British mountains is detailed by Jarman and Harrison (2019) who report an inventory of 1082 sites and discuss the importance of concentrated bedrock erosion (CED) in intensifying slope instability and being the major causal factor of RSF.

Many forms of relict mass movement on hillslopes exist in the Irish landscape but there are currently no comprehensive maps or summary lists for many parts of the Irish uplands despite there being very clear examples reported on and dated in the north of the country (Ballantyne *et al.* 2013*;* Wilson 2017).

Recent advances in dating are providing a far clearer picture of Ireland's LGM ice extent and timing (e.g. Ballantyne and Ó'Cofaigh 2017), the subsequent collapse of the LGM ice (e.g. Foreman *et al.* 2025) and Late-glacial (Nahanagan Stadial) geomorphology, ice extent and timing of ice retreat (e.g. Knight *et al.* 2025). However, the superimposition of RSF on the Irish landscape has yet to be researched in detail as many of the geomorphological features associated with such slope instability have been overlooked or misidentified. Advances in dating methods would also allow a fascinating insight into the timing of such slope instability in Irish uplands.

The RSF that will be described here are just two of many that are scattered amongst the Connemara (and other) mountains: 1. A wedge slide on Northwestern flank of Letterbreckaun in the Maumturk Mountains with a debris apron of approximately 120,000m^2. 2. An rock slide with a dissagregated debris field (rock avalanche) below covering a massive 1km^2 on the Western flank of Derryclare in the Twelve Bens.

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Boots, crampons, polkas and imagination over icy places

Michael Guilfoyle

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Michael's fascination with glaciers was sparked as a 10 year old by a 1956 visit to Coumshingaun in the Comeraghs Mountains. His Father told him of huge ice flows that "took a bite out of the mountain", as he described the work of a massive mountain glacier. This of course was literally unimaginable to his young mind. Since then Michael read Farrington and Praeger in his twenties and thirties in the proceedings of the RIA, particularly in relation to the glaciation of the Wicklow uplands. He has endeavoured to keep up with the latest findings of geomorphologists and to bring an acquired amateur knowledge to bear on reading the landscape, and helping others also to do so, as a traveller and hiker. He got up close and personal in 1990 with probably the first Irish attempt to traverse the glacial period remnant icecap of Vatnajokull in Iceland. Otherwise Michael is a retired Civil Servant and regular travel writer with the Irish Times and with Mountain Log and other hills-oriented publications. His presentation covers the story of his interest in landscape, particularly in the long lost imagined glaciers and icecaps that gave us such a beautiful, fresh and new Irish landscape.

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