



1. Introduction

Dear IQUA member,
Welcome to newsletter No. 50.

Thanks to all who attended the very successful Autumn Symposium held at the GSI last November. An excellent and varied programme of speakers (see extended abstracts below – item 5) proved very inspiring and stimulated much discussion on recent and future research in Remote sensing: Applications in Quaternary science, archaeology and landscape management. Thanks to all the speakers and organisers of the event and the GSI for facilitating the meeting once again. Special thanks to Steve Davis for arranging the wide array of speakers and the beautifully presented programme. Due to the huge turnout on the day there was a shortage of programmes and anyone who did not receive one can download a copy from the IQUA website (www.iqua.ie). After the conference we were treated to a personal account and tribute to Frank Mitchell's lifelong interests and research by Pete Coxon. Thanks to Pete for this fitting and personal tribute on the centenary of Frank Mitchell's birth.

Last year, we also ran a very successful fieldtrip to the Roscommon and South Sligo area (see item 4 for details). It was one of the best attended IQUA fieldtrips in recent years. Thanks to all who attended and shared their inspiring knowledge of the Quaternary and archaeological features of this fascinating region. More detailed discussions and summaries about the IQUA fieldtrip can be found in the accompanying IQUA field guide (no. 30), thanks to Bettina Stefanini and Gayle McGlynn.

This year we look forward to the upcoming Spring meeting and AGM (Saturday/Sunday 27th/28th April) – see item 3 for details – which is being held in conjunction with the Palaeoenvironmental Unit in NUI Galway. Our thanks go to Karen Molloy and Aaron Potito for organising this event.

Finally, thanks to all who contributed to this edition of the newsletter.

*Kind regards,
Ellen OCarroll, Feb 2013*

2. IQUA Committee (2012/2013)

The IQUA Committee is as follows:

President: Prof Fraser Mitchell, TCD (continuing)
Secretary: Dr. Bettina Stefanini, NUIM (continuing)
Treasurer: Dr. Gayle McGlynn, TCD (continuing)
Postgrad rep: Rory Flood, QUB (continuing)
Website manager: Dr. Francis Ludlow, TCD. (continuing)
Publications Secretary: Dr. Gayle McGlynn, TCD (continuing)
Newsletter editor: Dr. Ellen OCarroll, TCD (continuing)
Ordinary members: Dr. Steve McCarron, NUIM (continuing), Dr. Sarah Murnaghan, TCD (continuing), Dr. Steve Davis, UCD (continuing), Dr. Susan Hegarty, St. Patricks College, Drumcondra (continuing), Benjamin Thebaudeau, TCD (continuing)

3. IQUA Spring Meeting and AGM 2013

We are pleased to announce that the IQUA spring meeting will be hosted by the Palaeoenvironmental Research Unit, School of Geography and Archaeology, National University of Ireland, Galway.

Date: Sat 27th April 2013. Registration will at 9.30am. The Meeting will be followed by the AGM which will commence at 3.00pm. Organisers: Aaron Potito (Aaron.potito@nuigalway.ie) and Karen Molloy (Karen.molloy@nuigalway.ie).

The meeting will comprise a series of short (20 minute) talks and posters focusing on new and ongoing Quaternary research taking place in Ireland and abroad, and is open to all. Postgraduate and Postdoctoral members are particularly encouraged to use the opportunity to present their research in a friendly environment. 200 word abstracts to be submitted the organisers by 5th April.

If you are interested in giving an oral or poster presentation please submit an abstract (no more than 200 words) to the organisers (email: Aaron.potito@nuigalway.ie, Karen.molloy@nuigalway.ie) by Friday 5th April 2013.

As an optional extra to the Spring Meeting and AGM Michael Gibbons has most kindly volunteered to lead a **fieldtrip on Sunday 28th April** for those interested. The fieldtrip will focus on a range of sites, including a group of cairns on Ballyvaughan Bay, a seaweed farm visible in the inter-tidal zone on Aughinish Island (the best preserved example in the country) and a complex of midden sites on Kinvara Bay. Some contain bone. If the tides are right we will visit Mulrooney Island (a tidal inlet).

Depart Galway 10.30; finish c. 15.00.

This promises to be a fascinating trip that should be of interest to many members. Please let either Aaron or Karen (e-mail addresses above) know if you wish to attend the fieldtrip as we need to get an idea of numbers.

The Secretary (email: bettina.steffanini@nuim.ie) welcomes suggestions for Agenda Items up to Friday 1st April 2013 for the AGM. The Agenda will be circulated before the meeting, and will include proposed changes to the Committee.

More details on the venue location and submitting an abstract are available on the IQUA Meetings webpage.

We look forward to seeing you in Galway!

4. IQUA 2012 Annual Fieldtrip

IQUA Fieldtrip to Roscommon and South Sligo, 7th-9th September 2012.

Bettina Steffanini & Gayle McGlynn, Department of Geography, NUI Maynooth and Department of Geography, Trinity College Dublin.

IQUA's field trip to Roscommon and South Sligo was very well attended and was an exciting mix of archaeological, geological, historical and botanical records and sites from the area. Indeed the trip was so well attended that we had to split up into two groups for the morning site visits. Details can be found in the IQUA field guide (No. 30) prepared for the trip by Bettina Stefanini and Gayle McGlynn (2012).

The inspiration for visiting this area grew out of two recent projects, each of which examined landuse change due to profound societal restructuring. One looked at climatic controls, vegetation dynamics and their effects on the burgeoning Neolithic society which had positioned its monuments so dramatically on the Bricklieve Mountains of south Sligo. The other explored the changing landuse around the focal point of the Rathcroghan complex and Tusk during its medieval heyday and later transition into Anglo-Norman patterns. Underpinning these social themes, the framework of karst features and glacial topography that make up the surface structure of this unique area were examined and areas of such unique landforms were also visited.

A large gathering of IQUA field trippers assembled in Tullys Hotel in Castlerea on Friday night. Here we were treated to two excellent lectures by Mary Kelly on "Why the Famine Affected Castlerea Differently to Other Places in Co. Roscommon", and the second by Kevin Barton on "Geophysical Explorations of the Rathcroghan Mound and their Intriguing Possibilities". Roscommon's population was reduced by over 31% during the famine period which was above the national average of ca 23%. The details of this population decimation were described by Mary Kelly and can be attributed to many factors such as small land holdings, corruption at the depots which were set up to provide corn and seeds, inadequate poor house facilities and a lack of soup kitchens. All in all a very thought-provoking lecture and a look at the human aspect of the social history in the area.

On Saturday morning, we divided into two groups to facilitate the small numbers allowed at a time into

Oweynagat (Cave of the Cats) – which proved to be an exciting adventure! After some hesitant gasps regarding the size of the hole we had to clamber through most of us entered the small opening and into the most marvellous passage or natural limestone cave. Gary Dempsey gave us a descriptive account of the associations of the caves with famous people who had visited the cave and written about it as well as its place within the local folklore of the extended region. Gabriel Beranger first recorded a local folk tale in 1779 and it was also visited by John O'Donovan during the Ordnance Survey. An Ogham stone (inscribed early medieval stone) is part of the entranceway feature into the cave and Douglas Hyde's inscription can also be seen on one of the rocks near the entrance to the cave. A very enjoyable and spiritual experience and a place I will definitely return to with my adventurous boys. So much history and archaeological hidden through a small gap or opening in a hedge!



Entrance to the Oweynagat caves and the dark recesses inside the cave

Each group also visited the Tusk and Carns region of Co. Roscommon where Brian Shanahan discussed the most recent research with regards the prehistoric and Medieval landscapes of the area which was completed under the auspices of the Discovery Programme. Carnfree was the inauguration place of the O'Connor dynasty. The cairn is shown below in the photograph and is located on the highest point of an east-west running ridge.



IQUA members on top of the Cairn at Carnfree

The prehistoric cemetery complex at Carnfree may have been the focus for a later Iron Age and Early Medieval dynastic centre, associated with the Uí Bhriúin Aí. Similarly Tusk which is located a few Kilometers north of Carnfree was visited for lunch at the Cruchan Aí Heritage centre and contains a wealth of Medieval archaeological remains. The remains of the Dominican friary, the traditional site of a castle, located behind O'Connor's pub and a prominent earthwork in the field opposite the priory can be seen in the village.

Next stop on the excursion included an introduction to the use and applicability of remote sensing and geophysical prospecting at Rathcroghan mound and its surrounding archaeological sites by Kevin Barton. Rathcroghan, which is one of the so-called 'royal sites' of Ireland, is located northwest of Tusk. It is described as a royal residence and burial place in early Irish literature. The complex consists of over sixty monuments which includes burial mounds, linear earthworks and enclosures. Topographic and geophysical surveys of the mound and its environs have revealed a complex sequence of structures and enclosures. In fact the mound is located within a large enclosure, measuring 360 m in diameter. A fascinating landscape of archaeological monuments which was really brought to life through the descriptions and discussions by Kevin Barton.

Across the road from Rathcroghan Mound we were shown a series of pitfields which prompted much discussions as to their function and nature and if their origins were geological or archaeological in nature (see photo below). The pits are c. 10 m in length x c. 2-3 m in width with depths up to 0.5 m and arranged in a linear fashion. Their form and arrangement would prompt me to think that these pits were man-made, possibly used for soaking or small retting ponds. Many suggestions and

functions were discussed and it would be interesting to carry out more research and interpretations as to the functionality of these pits.



IQUA members at one of the enigmatic pits (area filled with water).

Conservation of turlough habitats and their biodiversity brings us to our next port of call. Brierfield turlough site was so much larger than I had expected and appeared as a sandy oasis in an otherwise green farmland region. Turloughs are groundwater-dependent wetlands characteristic of karst areas in western Ireland. They are filled with water for some of the year, emptying to groundwater with no surface output. Standing in the centre of the turlough beside the swallow hole felt like we were inhabiting a different planet. Thanks to Nova Sharkey and Sarah Kimberley for taking us there and sharing their extensive knowledge of these site types with us.



Brierfield turlough



A swallow hole at the Turlough site

The last stop of the trip was to look at the karst and groundwater systems of the area. Caoimhe Hickey and her amiable assistant David Drew (who held up

the lovely presented posters!) were our guides on this geological tour of the Roscommon area which is comprised mostly of limestone. Two-thirds of the rocks in the county have been categorised as regionally important karstified aquifers which are characterised by conduit flow. Karstification is an important process in Irish hydrogeology.

On Sunday morning, our first stop was to the magnificent Heapstown Cairn, where Robert Hensey explained the fascinating history of such sites in Ireland. The rain obligingly cleared for long enough for us to climb up the cairn for a closer look and to enjoy the misty view. The cairn was formerly much larger in size but huge amounts of it were removed to build roads and walls in the past. The Cairn is part of the Carrowkeel complex of passage tombs which was where the trip headed to investigate next. After the climb up the Bricklieve Mountains IQUA field members were rewarded with a close look at the passage tombs that can be seen on top of the mountains as you drive along the N4 to Sligo. Much debate ensued as there is relatively little known about these passage tombs. Discussions were then cut short by a car parking drama which could be seen from the mountain tops. There was a quick clamber down the mountains to the parked cars after which Susann Stolze talked about the palaeoenvironmental evidence from the area. Pollen evidence from Lough Availle shows a marked change in the woodland community associated with a decline in the local elm population

in the Early Neolithic periods marking an increase in human impact in the area around the time period of the construction of the passage tombs at Carrowkeel. The proxy records from the nearby lakes of Loughmeenaghan and Templevanny Lough also support the observations from Lough Availe that particularly warm and dry conditions prevailed during the Early Neolithic (Stolze, 2012; Stolze et al., 2012). During this period, human impact was most pronounced at both lake sites, as suggested by arboreal pollen values of c. 65% of the terrestrial pollen sum and the abundance of wild grass pollen and *Plantago lanceolata* type pollen.

With many thanks to Bettina and Gayle and the other leaders for a marvellous weekend.

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5. IQUA 2012 Autumn Symposium

Remote sensing: Applications in Quaternary science, archaeology and landscape management

Friday 30th November 2012

Abstracts:

Keynote Address: Advancing the documentation of buried and submerged landscapes

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Over the past decades landscape archaeology has increasingly gained importance. Despite a large variety of different approaches, a tacit agreement consists in the fact that landscape archaeologists are investigating beyond the individual site, dealing with space at different scales. This has led many archaeologists as well as preservationists to enlarge their field of endeavour from sites towards archaeological landscapes. In order to be able to protect archaeological landscapes, these have to be identified and documented, using fast, efficient and reliable prospection methods that can cover large areas. Also, archaeological prospection is usually defined as tools and methods to gain knowledge on archaeological sites before or instead an archaeological excavation. However, this does not fully apply to the potential of archaeological prospection, which can also reveal important information on palaeoenvironmental structures, especially from the Quaternary. To do so, archaeological prospection has to be applied mainly on a large-scaled basis. Therefore, large-scale application of non-invasive archaeological prospection methods (e.g. aerial archaeology, airborne laser scanning and high-resolution near-surface geophysical prospection) offer a great potential. They are the most appropriate solution in order to provide both landscape archaeologists and planning authorities with the necessary spatial information at multiple scales, ranging from the archaeological site to the entire archaeological landscape.

The presentation will therefore focus on a wide range of prospection methods that can be applied

on a landscape scale in a variety of environments. It will demonstrate the latest developments in aerial archaeology, airborne laser scanning, airborne imaging spectroscopy, but also geophysical methods (mainly magnetics and ground penetrating radar). It will finally discuss the possibilities and limitations of bathymetric sensor technique in the attempt to overcome the border between land and water.

Arriving at the same point: Method and technologies for the 3D modelling of landscapes

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Since 1996 the Discovery Programme has been at the forefront of applied research in the recording and modelling of archaeological landscapes and monuments using a range of remote sensing techniques and methods. The application of remote sensing techniques within archaeology and cultural heritage has enabled the rapid and accurate recording of a range of monuments from the earthen structures of Tara to the extreme topographic features of Skellig Michael, revealing new archaeological features or recording areas where conventional survey would be impossible.

This presentation will highlight a selection of remote sensing examples from Ireland which range in both scale and topographic character. It will discuss the benefits and costs of a range of approaches including lidar, photogrammetry and terrestrial laser scanning and explore how the results of these surveys have increased our understanding and management of archaeological sites and landscapes. Finally it will discuss how the combination of several remote sensing techniques and applications can provide a powerful toolkit in the non-destructive analysis of the past and enable a more qualified approach to the investigation of subsurface features.

Geophysical imaging in geological and archaeological investigations in some Irish wetland environments

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Wetlands are composed of many shapes, sizes, sediment types, vegetation and, in particular for the practical aspect of geophysical surveying, have varying degrees and types of water saturation. These environments present many challenges in geophysical investigations both in field surveys and interpretation. Wetland environments often do not have a depth of water suitable for use of a boat as a survey platform. Field conditions with unpredictable, soft, yielding ground make for difficulties in carrying out systematic area surveys often required in geological and archaeological investigations. The survey area may be not stable enough to walk on or drive on using hand-carried or towed survey instruments. In addition potential geological and archaeological targets have to have a sufficient size or volume combined with a detectable physical property contrast with the host or background sediment. If the particular field conditions are suitable and the target and survey area has geophysical potential the next step is to assess the measurements that need to be made and the method of deployment of suitable instruments.

It is therefore in the combination of field conditions, target type and size, possible contrasts with host sediments, appropriate geophysical technique and mode of instrument deployment where the challenge lies in specifying and successfully carrying out a geophysical survey in a wetland environment. In blanket bog and tidal wetlands the Electrical Resistivity Tomography (ERT) technique has been successful in geological and archaeological investigations.

This presentation will discuss the ERT technique in the experimental mapping of the sub-peat extent of Glenulra Court Tomb in the blanket bog of Céide Fields, Co. Mayo. Here cutaway bog with variable topography and saturation prevented the use of conventional geophysical techniques used in archaeological investigations. The utility of the ERT technique will be shown through its use in a geo-archaeological investigation of the Woodstown tidal wetland, Co. Waterford. Here ERT was used to map a tidal embayment of the River Suir to assist in the location of coring sites crucial to a palaeoenvironmental reconstruction of the wetland adjacent to the Viking Age Woodstown 6 site.

Acknowledgement

The Woodstown project was funded by the National Roads Authority and Waterford City Council.

References

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Investigation of Quaternary sediments using 2D time-lapse electrical resistivity tomography

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Electrical Resistivity Tomography (ERT) data can provide detailed subsurface information and they are influenced by a number of factors associated with the subsurface such as porosity, moisture content and lithology; as well as external factors such as rainfall and temperature. Little work has been carried out in Ireland on the additional information that can be obtained from time-lapse ERT. Two experiments were conducted to determine how resistivity varied with time. One short experiment was controlled and provided very detailed information about shallow temporal variations in resistivity as a result of a point source 'pollution' event. Initial changes were mainly confined to the top 25cm and the wetting front moved at a rate of about 1m per hour. The second experiment was considerably larger both spatially and temporally. In this instance, two time-lapse ERT profiles with 5m and two with 2m electrode spacings were acquired over a range of Quaternary sediment types encompassing till, esker gravel, glaciofluvial sand and silt and glacio-lacustrine silt/clay. Data were collected for these four lines on the same day on a monthly basis for a year at a site located in the Irish midlands, see example in Figure 1.

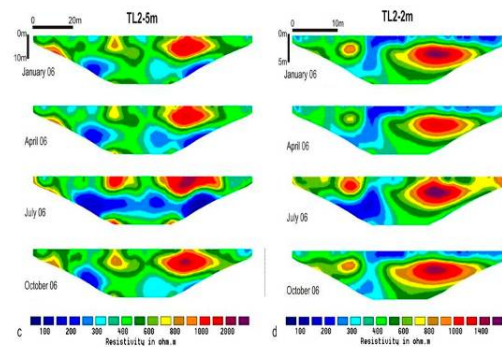


Figure 1

Effective recharge, the depth of investigation, the texture and the internal architecture of the different sediment types and temperature variation are the main factors influencing the resistivity seasonal variation. The shallow subsurface (<3m depth) showed a direct relationship between resistivity variation and effective recharge, whereas, an increasing time-lag between effective recharge and resistivity was recorded at increasing depths. As a result of the time-lag, it was possible to determine the rate of movement of the wetting/drying front for the unconsolidated relatively sorted coarse sediments at 7.8 cm/day. Conversely, poorly sorted and fine sediments show little resistivity variation and the velocity of the wetting front could not be estimated. Other factors influencing the electrical response of the subsurface are the electrode spacing used for data collection and the seasonal temperature variation of the subsurface. Two methods for temperature correction of electrical resistivity data were tested in this study — both gave similar results. Resistivity values recorded in the shallow subsurface (<5 m) show variations of over 15% due to temperature variation.

The Tellus Border Project: Regional geo-environmental mapping through airborne geophysics and geochemistry sampling

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Tellus Border is an EU INTERREG IVA-funded regional project which will map the environment of the six border counties of the Republic of Ireland- Donegal, Sligo, Leitrim, Cavan, Monaghan and Louth through airborne geophysical and ground-

based geochemical surveys. This joint initiative between the Geological Survey of Ireland, the Geological Survey of Northern Ireland, Dundalk Institute of Technology and Queens University Belfast follows on from the successful Tellus project which was recently completed in Northern Ireland. The work will provide scientific data which will inform environmental management and support sustainable development of our natural resources, including agricultural soils, groundwater and energy resources in the border region. Research projects based in Queens University Belfast will investigate the application of the airborne geophysics to the assessment of groundwater pollution plumes and peat depth.

Both geochemical and airborne geophysical components surveys were successfully completed during the summer of 2012.

The airborne geophysics survey operated as a low-level survey, measuring magnetic field, gamma-ray spectrometry and electrical conductivity along lines spaced 200m apart and in flight direction 345 degrees across the border region. The Geochemical survey entailed the collection of approximately 3500 samples each of soils, stream sediments, stream water and vegetation. The samples are currently being analysed in a laboratory for a range of chemical elements and compounds.

Following final data quality assessments, the data will be merged with existing surveys to provide a seamless dataset across the region allowing detailed interpretations. Final merged magnetic and gamma-ray spectrometry data will be available to the public following the launch of the data in early February 2013. The electrical conductivity data and results from the geochemistry programme will be available later on in 2013.

A Tellus Border research opportunity was announced in 2012 and researchers from all sectors will shortly be invited under several research themes to tender for funding. This call presents opportunities for interdisciplinary research using the world-class geochemical and airborne geophysics data newly acquired as part of Tellus Border and existing Tellus data from Northern Ireland.

Irish Quaternary Geological Mapping: Sediments and Geomorphology

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The Quaternary Section of GSI recently began a National Quaternary Map project. The project involves the integration of all previously mapped GSI Quaternary field data, Teagasc subsoil data and GSI subsoil permeability data, as well as available information from consultant's reports, academic papers and theses, and mapping projects, into a GIS. The integration of these data involves their re-interpretation into a consistent, seamless, national Quaternary classification scheme. This schema will facilitate compliance with INSPIRE terminology and fields.

The construction of the 'Map' coverage involves developing four separate ArcGIS geodatabase layers including; Quaternary geomorphology; Quaternary sediment type; depth-to-bedrock; and depth-of-sediment strata. These geodatabases will host several individual shapefiles and all will have up-to-date metadata constructed for them. The geodatabase coverage will be displayed on a backdrop of renditions of slope and elevation-shaded Digital Elevation Model data for Ireland, captured across a 10 m grid.

On completion of the project in 2013 a web viewer incorporating the four map layers, with print, download, WMS and other functionality will be made available on www.gsi.ie. The presentation will focus on the recently-completed pilot study for County Mayo, which covers almost 10% of the country. The geomorphological maps have uses in ice sheet modelling, morphological mapping and for educational and geodiversity purposes. The sediment, depth to bedrock and depth of sediment strata layers underpin applications in; geotechnics, environmental protection, aggregate potential mapping, geohazard mapping, soil modelling and Geological heritage.

Keeping our feet dry: marine geophysical tools for the study of underwater archaeology and Quaternary research

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The development of acoustical oceanography took off after the sinking of the Titanic in 1912 and was significantly improved as a detection technique during World War I. Since then, these acoustic techniques have evolved from detection (e.g. icebergs, submarines) to full exploration tools (e.g. the hydrocarbon industry). Furthermore, rapidly

evolving computer processing and digital recording in the last few decades have allowed the detection and imaging of geological, geomorphological and archaeological features lying on or buried within the seabed, down to the sub-metre scale.

Marine remote sensing techniques can be divided into two broad categories: techniques that (1) image the seafloor and objects laying on it or (2) image the sub-surface stratigraphy and objects buried within the sediments. Currently, the most commonly used instruments for archaeological and Quaternary research that fall within these categories are (1) multibeam echosounders and side-scan sonars, and (2) high resolution sub-bottom profilers. A more recently available non-acoustic remote sensing technique is bathymetric LiDAR (Light Detecting And Ranging), which has proven to work in very shallow waters.

On the island of Ireland, the scientific community has been blessed by readily available high quality marine geophysical data which can be used by a multitude of disciplines. Notable projects collecting such data include the INSS/INFOMAR (Irish National Seabed Survey / Integrated Mapping for the Sustainable Development of Ireland's Marine Resource) and JIBS (Joint Irish Bathymetric Survey). The data collected by these projects over the past decade have allowed an unparalleled view of the Irish seabed, which in turn affords a unique opportunity to study the natural and cultural history hidden beneath the water.

With respect to archaeology, these techniques have not only allowed us to detect shipwrecks, but also to study the wider environment in which such sites are situated and associated site formation processes, an important issue from a management perspective. A growing maritime archaeological discipline is the study of submerged landscapes: former terrestrial landscapes on which humans could have lived, but which have been inundated by postglacial sea-level rise. Such studies are closely linked to Quaternary research examining the extent and origin of ice sheets and the changing position of relative sea-level over the past 2.6Ma (but concentrating on the last c.24,000 yrs). Currently, signatures found on or within the seabed are often ignored, although they could provide important clues about former oceanic conditions around Ireland and potential migration routes for humans and animals.

This talk will illustrate some of the work that has been undertaken by archaeologists, geologists and geomorphologists from the University of Ulster using remote sensing techniques to investigate the wealth of information hidden beneath the waves.

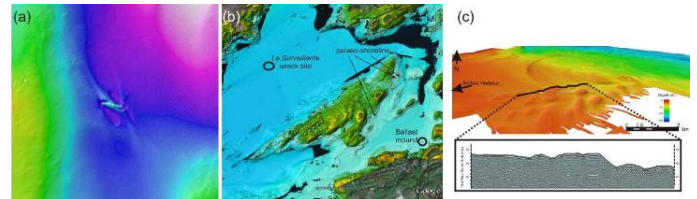


Figure 1. Examples of marine geophysical data showing (a) a shipwreck with associated scour, (b) seamless LiDAR and bathymetric data (Bantry Bay) and (c) bathymetric and sub-bottom data over a planed-off submerged drumlin field.

Beyond Red: Applications of Multispectral Remote Sensing in Geoarchaeology

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Multispectral remote sensing offers considerable advantages over conventional aerial imaging for the detection and mapping of geoarchaeological features. In particular the enhanced ability to distinguish slight variations in soil and vegetation properties in the infrared part of the spectrum greatly amplifies the visibility of ephemeral anthropogenic features and evidence for terrace and floodplain architecture in fluvial zones. Drawing on examples from river valleys and uplands in the UK this paper considers the principals, techniques and results of multispectral remote sensing, using both airborne and satellite sensors, for geoarchaeological prospection and mapping.

Applications of Remote Sensing in Flood Risk Assessment in Ireland

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The Office of Public Works (OPW) is the lead agency for flood risk management in Ireland. In this role, the OPW is undertaking a nationwide Catchment Flood Risk Assessment and Management (CFRAM) Programme. The purpose of this programme is to identify and map the existing and potential future flood risk areas and to develop Catchment Flood Risk Management Plans to address the identified risk.

The three main outputs of the CFRAM Programme are: Preliminary Flood Risk Assessment, Flood Hazard Mapping and the development of Catchment Flood Risk Management Plans. The first

two of these outputs are heavily reliant on remotely sensed data.

Preliminary Flood Risk Assessments (PRFA)

The first step in the CFRAM programme was to identify areas where there is a potential significant flood risk. Flood Risk is a combination of Flood Hazard and the vulnerability of Flood Receptors. Flood Hazard areas are the predicted extents of flood inundation. Flood Receptors datasets are used to reflect the impact that flooding has on human health, the environment, cultural heritage and economic activity.

Flood hazards are mapped by combining hydrological and hydraulic data with topographical information. In the case of the PFRA, the hydrological analysis (or estimation of flows at points down through the river network) was informed by remotely sensed datasets describing the river catchments, such as land-use, soil types, topographical characteristics and the structure of the river network. The topographical information used was a Digital Terrain Model (DTM) produced by Intermap from Interferometric Synthetic Aperture Radar (IFSAR) data captured in the autumn of 2007. The DTM has a vertical accuracy of 0.7m (RMSE).

Catchment Flood Risk Assessment and Management Studies

Based on the outputs of the PFRA the OPW has commissioned CFRAM studies to further maps and assess areas of significant risk and to produce Flood Risk Management Plans. To facilitate this the OPW have procured over 7,000 km² of lidar data in areas of significant risk. This lidar data has a vertical accuracy of 0.02m (RMSE).

This data is input to hydrodynamic models, in combination with river and bathymetric survey data and derived hydrological information, which are then integrated with DTMs of the surrounding floodplains to produce predictive flood extents. The resulting flood risk can then be quantified, by combining these flood extents with receptor data, many of which themselves are derived and mapped using remote sensing techniques.

Application of Remotely Sensed Data

This presentation will detail how remotely sensed data is used to derive the predicted Flood Hazard at the PFRA and CFRAM stages and to determine where this flood hazard interacts with Flood Receptors.

6. IQUA Annual Fieldtrip and Autumn Symposium 2013

A proposal is to hold the IQUA Annual fieldtrip in North Mayo and the Ballina area (September 2013). Suggestions of places or areas to visit in the north Mayo region are welcomed by the IQUA Committee (email: stephen.mccarron@nuim.ie).

Suggestions for an Autumn Symposium theme by potential convenors are also welcome (through the Secretary, Bettina Stefanini, bettina.stefanini@nuim.ie) for discussion at the AGM.

7. Recent PhD completions

Congratulations to Gayle McGlynn, Ellen OCarroll and Lisa Coyle McClung on their recent PhD completion. Abstracts/Summaries of these PhDs are outlined below as well as a picture of Ellen and Gayle at their recent graduation ceremony!



Holocene environmental change in the Albertine Rift: Sediment-based evidence from the Virunga volcanoes

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Environmental changes in the Albertine Rift – one of the most important conservation areas in tropical Africa – are influenced both by long-term climate

change and by human activity, although establishing clear cause–effect relationships is often problematic. The Albertine Rift supports exceptionally high levels of biodiversity (including rare and endemic montane flora and fauna), and is associated with some of the highest rural population densities on the African continent. An understanding of the long-term drivers of environmental change in this area is important in order to provide a context for the possible effects of future climate change and other environmental perturbations.

This study presents new well-dated (AMS¹⁴C, ²¹⁰Pb and ¹³⁷Cs) multi-proxy sedimentary evidence from crater sites at the summits of two of the Virunga volcanoes – a high-altitude area associated with the Albertine Rift, and located along the borders between Uganda, Rwanda and the Democratic Republic of the Congo – in order to reconstruct the mid- to late Holocene environmental history of the Albertine Rift, and in particular to evaluate the main drivers of environmental change in the area. High-altitude sites such as these provide excellent potential to reconstruct past environmental changes over a wide surrounding area, in addition to reflecting within-site variations. Records from the crater swamp on Mt. Gahinga (3474 m) and a crater lake on Mt. Muhavura (4127 m) were dated to ca. 8000 cal yrs BP and ca. 3000 cal yrs BP, respectively. Multi-proxy sediment-based analyses provide evidence for significant environmental changes in the area during the last several thousand years. Pollen and charcoal records show that climate changes linked to variations in monsoonal activity during the mid-Holocene have been an important driver of environmental change, particularly vegetation change, both at high-altitude sites and in the surrounding areas of the Albertine Rift. However, the asynchronous timing of vegetation responses highlights the differential effects of climate on different vegetation types.

Human-induced environmental impact in the Albertine Rift is apparent in the sedimentary records from the sites in the Virunga volcanoes only within the second millennium AD, despite the long history of human occupation of the area. The sediment sequences from both study sites indicate a significant forest clearance event at ca. 900 cal yrs BP, involving a reduction in lower montane forest taxa and increases in disturbance indicators. This period coincides with the onset of the Late Iron Age in the region, and thus highlights the increased role of human-induced environmental change since that time. Furthermore, significant changes in upper montane forest, possibly linked to changes in the fire regime associated with increased human activity, are also apparent from ca. 900 cal yrs BP.

This highlights the widespread extent of human modification of the landscape within the last millennium, even in high-altitude areas previously thought pristine. The role of natural, long-term climate change as a major cause of environmental change in the Albertine Rift has thus been eclipsed within the last millennium by human-induced environmental effects.

Quantifying woodland resource usage in the Irish midlands using archaeological and palaeoecological techniques

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This thesis examines charcoal methods in relation to archaeological sites and woodland resource usage using a variety of anthracological and palaeoecological approaches as well as literary evidence at different spatial and temporal scales. A number of hypotheses were set up to test the data sets with regard to woodland dynamics, human taphonomies as well as relationships between the data sets.

The new route of the N6 dual carriageway in the midlands of Ireland is the main focus for this research starting at Athlone, Co. Westmeath and running eastwards through Co. Offaly towards Kilbeggan and Kinnegad for a length of approximately 61km. Charcoal data from archaeological excavations along the length of the new road as well as new and existing pollen data from sites adjacent to the road were used in this research.

Recommendations on minimum charcoal fragment counts to identify per sample and quantity of samples to identify with regards specific site types are presented. Mean saturation points of taxa amounts per sample are lower than expected for most site types evaluated which has important implications for recommended sampling strategies. Quantity of samples for analysis varies from site type to site type. By combining all results from saturation curve profiles a minimum of five charcoal samples are recommended for analysis from *fulachta fiadh* sites, six from small scale industrial sites and twenty three from occupation.

Optimal fragment count for taxa diversity from within each sample has been set at a minimum of 30

fragments. The quantity of charcoal fragments identified per sample can be adjusted to take into account precision of determining taxa proportions and associated margin of error. Thus the charcoal fragment counts can be adjusted upwards depending on cost factors and specific research questions that need to be addressed.

The results show interesting patterns of wood selection for various cultural uses in the Medieval Periods in comparison to prehistoric periods where wood selection patterns are not as apparent. Therefore vegetation reconstruction related to the prehistoric periods is more accurate than the Later Historical time zones. However charcoal production pits which were used throughout all Medieval Periods show the consistent use of *Quercus* within these pits indicating that *Quercus* woodlands were still extant and most likely extensive in the study area during the Medieval periods. Therefore there is some merit in using archaeological charcoal to construct local arboreal dynamics in the Medieval periods, pertaining to particular site types.

The pollen datasets are cross compared to the archaeological charcoal data to determine if the proportions of charcoal of varying taxa identified correspond to arboreal vegetation close to the study area across nine time periods during the mid to late Holocene. Similarities between the pollen and archaeological charcoal data sets can be determined through certain taxa and not through others. However these similarities are not represented by taxa proportion sizes but instead are shown through similar trends in fluctuating patterns and also through the absence/presence of certain taxa during specific time periods.

Following on from this the presence and absence of certain tree types in the archaeological record can indicate patterns of woodland change but do not directly relate to vegetation proportions in the associated landscapes. Charcoal data can be then cross referenced with the pollen records to validate the assumptions or hypothesis. Moreover, the pollen data display more similarities with the archaeological charcoal data when spatial factors are accounted for. Therefore the closer a pollen core is to the archaeological resource the better. Similarly the pollen data compares well with the archaeological literary and plotted archGIS evidence for site types in the area except for the Iron Age where they differ. It is believed that the woodland resources required for iron working sites in the early Iron Age may have been extensive and as such contribute more than was previously recognised to the loss of arboreal taxa during this period.

A palynological investigation of land-use patterns in first millennium AD Ireland

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The first millennium AD in Ireland encompasses the obscure prehistoric Late Iron Age Period and the thriving historic Early Medieval Period, which includes the arrival of Christianity, the Vikings and the establishment of the first towns in Ireland. Several cultural changes are noted throughout this period, the impetus for which has been attributed to a variety of factors including climatic change, environmental catastrophes or socio-economic and political upheaval.

This thesis uses palynology to reconstruct land-use patterns for the north of Ireland. Previous palynological research has also been appraised to examine shifts in the subsistence economy and by extrapolation changes in land-use and perhaps settlement patterns. Published climate reconstructions for the period have been evaluated to assess the possible impact of climate on cultural changes. The documentary sources have been examined to gain insight into the social dynamics for the Early Medieval Period, including its social structure and the occurrence of famines and diseases. The role of political turmoil, which includes territorial disputes and the impact of the Vikings, has also been assessed.

This research has found that variations in land-use across Ireland have not necessarily been prompted or facilitated by environmental events. The Late Iron Age Lull has previously been regarded as the result of a widespread population collapse following a climatic deterioration. This research suggests that reduced human activity was more likely a symptom of socially driven changes such as the fragmentation of large regional political centres. A reopening up of the landscape before the arrival of an early missionary Church is clearly identified but the diachronic evidence suggest that neither it was prompted by a wholesale intrusion into Ireland nor by climatic changes, and socio-political developments offer a more likely scenario. The AD540 event is not apparent in the palaeoenvironmental records, but there is some evidence of a reduction in activity at this time. Changes to the archaeological record during the closing centuries of the study period are accompanied by agricultural expansion and

diversification. This could be attributed to changing political structures with the emergence of the powerful feudal lords and/or an intensification of farming to provision the burgeoning towns from this time.

8. Bill Watts 14CHRONO Awards

The winners of the Bill Watts 14CHRONO Awards 2012 were Marian McGrath UCC, Donna Hawthorne TCD and Philip Stastney, University of Reading, with two dates each. The Awards pay for a number of AMS radiocarbon dates for current postgraduate members of IQUA and they will each present the results of their research at future IQUA conferences and editions of this newsletter.

9. Quaternary News

Lewis Penny Medal

Dr Graeme Swindles has been awarded the Lewis Penny medal by the Quaternary Research Association (QRA).

Dr. Benjamin Geary

We would like to welcome Dr. Benjamin Geary over to Ireland. Dr. Geary, newly appointed lecturer in the Department of Archaeology, UCC, is an environmental archaeologist with a special interest in the archaeo-environmental record of raised bog systems in Britain and Ireland. He has previously been involved in a range of research and commercial wetland archaeological projects including the Humber Wetlands Project, the Lisheen Mine Archaeological Project and palaeo-environmental analyses associated with the M3 road scheme, Co. Meath. He was also a director of the Birmingham University-based palaeo-environmental research group, Birmingham Archaeo-Environmental before taking up his new position in Cork.

Wicklow Ice Age Tour

Dear Member,

If you came to the Wicklow ice age tour last May you will remember that it made for a wonderfully interesting day. Ben has put together a self guided version of the tour which can now be accessed through the Wicklow Heritage website at: www.countywicklowheritage.org/page_id_73_path_.aspx

For a more detailed background, you can buy the beautifully illustrated field guide through our website: www.iqua.ie/field_guides.html

Very special thanks again to the authors Pete Coxon, Patrick Wyse Jackson and Fraser Mitchell and to Ben Thebaudieu for organising the online and Google map versions. Many thanks also to Wicklow County Council for their sponsorship.

Enjoy!

10. Forthcoming workshops, seminars & conferences

The Irish Geological Research Meeting (IGRM) is on in Derry from the 1st-3rd March
(website: <http://igrm2013.info/>):

56th Irish Geological Research Meeting 2013
University of Ulster, 1st – 3rd March 2013

The 56th Irish Geological Research Meeting (IGRM) will be hosted by the University of Ulster on its Magee Campus in Derry city. The IGRM brings together geoscientist of all disciplines (e.g. geological/geochemical/geophysical) to discuss geological research taking place in Ireland or geoscience research that has an Irish context. The meeting is primarily aimed at providing young scientists the opportunity to present and discuss their research with the general Irish geoscience community.

The meeting will be opened on Friday evening (1st March) with an invited talk, a number of theme based sessions will then occupy the following two days with no parallel sessions taking place. As in previous years, registration at the conference is free. We encourage oral presentation submissions from PhD students and early stage researchers.

The TELLUS Border data launch is on the 5th February, more details on the GSI website: <http://www.gsi.ie/Events+Diary/Events/Dublin+05Feb+Tellus+Border+Data+Launch.htm>

Slieve Ardagh fieldtrip led by Phelim Lally from the Mining Heritage Trust of Ireland (MHTI), 9th - 10th March 2013, website: <http://en-gb.facebook.com/pages/Mining-Heritage-Trust-of-Ireland/165987500136619>

It is with great pleasure to make a special mention to the organisation and participation of staff and postgrads from Queen's Geography, Archaeology and Palaeoecology (GAP), staff and students from Methodist College Belfast, the GSNI, the GSI and the Northern Ireland assembly members and researchers for their involvement in a geology day for schools at Stormont on 22nd January. It was a highly successful event to encourage 4th year students to pursue studies and careers in geology and earth sciences. Students were given the opportunity to ask MLAs and NI assembly staff questions regarding policy and careers on a whole host of topics. This was followed by a debate between MCB students facilitated by QUB postgrads from GAP chaired by Prof Alice Brown (Former Vice-Principal, University of Edinburgh. General Secretary, Royal Society of Edinburgh) on a proposed fictitious gold mine development in Tyrone. The hard work and effort in organising the event (with the terrible snow conditions) really paid off and it was a great day for students and teachers of Methody, staff from the GSNI, GSI, NI assembly, and the staff and postgrads from Queen's.

*Rory Flood, Postgraduate Research Student
School of Geography, Archaeology and
Palaeoecology, Queen's University Belfast*

11. Recent Publications:

Armit, I. Swindles, G.T., Becker, K. 2013. From dates to demography in later prehistoric Ireland? Experimental approaches to the meta-analysis of large 14C data-sets. *Journal of Archaeological Science* 40, 433-438.

Charman, D.J., Beilman, D.W., Blaauw, M., Booth, R.K., Brewer, S., Chambers, F.M., Christen, J.A., Gallego-Sala, A., Harrison, S.P., Hughes, P.D.M., Jackson, S.T., Korhola, A., Mauquoy, D., Mitchell, F.J.G., Prentice, I.C., van der Linden, M., De Vleeschouwer, F., Yu, Z.C., Alm, J., Bauer, I.E., Corish, Y.M.C., Garneau, M., Hohl, V., Huang, Y., Karofeld, E., Le Roux, G., Loisel, J., Moschen, R., Nichols, J.E., Nieminen, T.M., MacDonald, G.M., Phadtare, N.R., Rausch, N., Sillasoo, Ü., Swindles, G.T., Tuittila, E-S., Ukonmaanaho, L., Väliranta, M., van Bellen, S., van Geel, B., Vitt, D. H., and Zhao, Y. 2012. Climate-related changes in peatland carbon accumulation during the last millennium. *Biogeosciences* 9, 14327-14364.

Ghilardi, B. and O'Connell, M. 2013. Early Holocene vegetation and climate dynamics with particular reference to the 8.2 ka event: pollen and macrofossil evidence from a small lake in western Ireland. *Vegetation History and Archaeobotany* 22, 99-114.

Ghilardi, B. and O'Connell, M. 2012. Fine-resolution pollen-analytical study of Holocene woodland dynamics and land use in north Sligo, Ireland. *Boreas*, DOI: 10.1111/j.1502-3885.2012.00292.x, 27 pp

Knight, J. 2012. The last glaciation of Aran Island and Cruit Island, County Donegal, north-west Ireland. *Irish Journal of Earth Sciences* 30, 49-58.

Knight, J. and Harrison, S. 2013. The impacts of climate change on terrestrial Earth surface systems. *Nature Climate Change* 3, 24-29.

Diodato, N., Knight, J. and Bellochi, G. 2013. Reduced complexity model for assessing patterns of rainfall erosivity in Africa. *Global and Planetary Change* 100, 183-193.

Knight, J., Keiler, M. and Harrison, S. 2013. Impacts of recent and future climate change on natural hazards in the European Alps. In: McGuire, W. and Maslin, M. (eds) *Climate Forcing of Geological Hazards*. Royal Society/John Wiley & Sons, London, 223-249.

McGlynn, G., Mooney, S. and Taylor, D. 2013. Palaeoecological evidence for Holocene environmental change from the Virunga volcanoes in the Albertine Rift, central Africa. *Quaternary Science Reviews* 61, 32-46.

Mitchell F.J.G, Stefanini, B.S. and Marchant, R. 2013. A catalogue of Irish pollen diagrams. *Biology and Environment: Proceedings of the Royal Irish Academy*, 113B(1), DOI: 10.3318/BIOE.2013.04

O'Carroll, E. and Mitchell, F.J.G. 2012. Charcoal sample guidelines: new methodological approaches towards the quantification and identification of charcoal samples retrieved from archaeological sites. *Sagvntvm Extra: Wood and Charcoal, Evidence for Human and Natural History*, 13, 275-282.

Plunkett, G., McDermott, C., Swindles, G.T. and Brown, D.M. 2013. Environmental indifference? A critique of environmentally deterministic theories of peatland archaeological site construction in Ireland. *Quaternary Science Reviews* 61, 17-31.

Swindles, G.T., Morris, P.J., Baird, A.J., Blaauw, M. and Plunkett, G. 2012. Ecohydrological feedbacks confound peat-based climate reconstructions. *Geophysical Research Letters* 39, L11401.

Turner, T.E. and Swindles, G.T. 2012. Ecology of testate amoebae in moorland with a complex fire history: implications for ecosystem monitoring and sustainable land management. *Protist* 163, 844-855.

Turner, T.E., Swindles, G.T., Charman, D.J. and Blundell, A. 2013. Comparing regional and supra-regional transfer functions for palaeohydrological reconstruction from Holocene peatlands. *Palaeogeography, Palaeoclimatology, Palaeoecology* 369, 395-408.

12. General Membership Items

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

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PayPal allows you to pay securely with your credit/debit card via the IQUA website. Please see the link below. Simply click on the relevant "Pay

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IQUA Treasurer:

Gayle McGlynn, Department of Geography, Museum Building, Trinity College, Dublin 2.
Email: mcglyng@tcd.ie

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B. Steffanini, IQUA-L Moderator

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