

Research Experience Placement (REP) Scheme

Project Supervisors:

Dr Maarten van Hardenbroek, co-supervisor (ECR): Dr Roseanna Mayfield

Host Organization and Department (if applicable):

Geography, Politics and Sociology, Newcastle University

Project Title:

Creating a chironomid-based temperature reconstruction for Donegal, Ireland

Project Description:

The project aim is to produce a quantitative temperature reconstruction from Lough Barra (Donegal, Ireland) using chironomid remains preserved in lake sediments. Detailed quantitative climate records are essential for providing the environmental backdrop of human activities in (pre)historic period. Few continuous high-resolution temperature reconstructions exist for the UK and Ireland covering the last 3000 years. There are, however, a number of distinct climatic fluctuations for this region, including the Little Ice Age, Medieval Climate Anomaly, Roman Warm period, Iron Age Cold Epoch, and Bronze Age Optimum.

Creating long-term climate records in the UK and Ireland is not straightforward; most potential locations for palaeoclimate records have a long history of anthropogenic disturbance going back as far as the Neolithic. These disturbances often interfere with the climatic 'signal' in palaeoenvironmental records. Anthropogenic disturbances include clearance, livestock grazing, and agriculture (at least as far back as the Neolithic), leading to substantial changes in nutrient regimes of terrestrial and aquatic systems. By carefully selecting a site at higher elevation and away from human activity, we minimise anthropogenic disturbances.

Using chironomid remains for quantitative temperature reconstructions has been widely applied for Late-glacial and early Holocene sequences. This insect group has proven to be a highly sensitive to temperature fluctuations and their remains can be identified to a high level of taxonomic detail. Statistical methods to estimate past temperatures using modern calibration data sets (so-called transfer functions) are available and the project will apply this transfer function approach to this new radiocarbon-dated record from Lough Barra.

Skills and Career-Development Opportunities:

The project involves hands-on training in laboratory skills (sample processing, chironomid identification using microscopy), as well as one-on-one training in statistical approaches (multivariate statistics and the use of transfer-functions for quantitative temperature reconstructions), which are highly transferable skills. There is also an option (if the student wants to) to join a field campaign to the islands of Arran or Jura (Scotland) for retrieving an additional sediment record for climate reconstructions, which includes training in lake sediment coring, core logging, and subsampling. This is another field site than the one which is the focus of the placement project (this is a radiocarbon dated sequence from Lough Barra, Donegal, Ireland), but the coring techniques and experience to the student will be identical.

Wider context of research:

The project will offer insight in all steps involved in a palaeolimnological research project, from coring, to sample processing and data generation to statistical analysis. Additional discussion and training will be provided to the student about creating core chronologies

including using the rbacon package for age-depth modelling. Furthermore, it is intended that the data produced will lead to a scientific publication and the applicant could take an active role in writing this publication (after the placement) if that is desirable to the student.

Project Timeframe:

28-30 June 2021 – Training in sample processing and initial chironomid identification
1-3 July 2021 – sample processing and sieving
4-30 July 2021 – chironomid picking and identification
3-6 Aug 2021 – training on statistical approaches using preliminary data
9-13 Aug – possibility to join lake coring fieldwork to Arran or Jura
16-20 Aug – chironomid identification
23-27 Aug – statistical analysis of data and writing short report of findings