

## CHARACTERISING PALEOLAKE RIADA CONDITIONS DURING DEGLACIATION OF THE CENTRAL IRISH MIDLANDS

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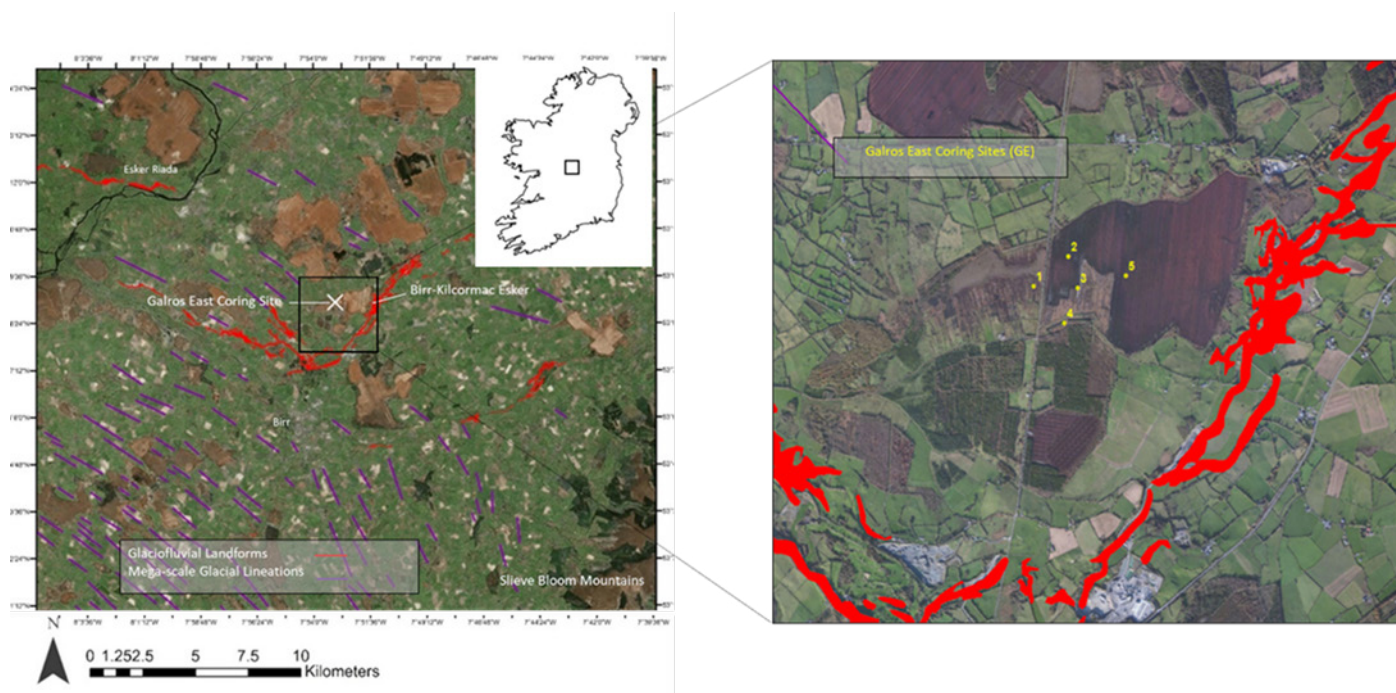
Funding from the QRA New Research Workers Award (NRWA) was used to fund two weeks of fieldwork undertaken to sample glaciolacustrine sediments deposited in Paleolake Riada in the central Irish Midlands. Paleolake Riada was a large (maximum area 2112 km<sup>2</sup>) ice contact lake that formed c. 17-15 ka during ice recession across central Ireland during the Last Glacial Termination (LGT) (Delaney, 2022).

To date, several studies have described the extent and characteristics of Paleolake Riada through the identification and description of subaqueous glaciofluvial geomorphology (Delaney, 2022; Delaney *et al.*, 2018; Gallagher *et al.*, 1996; Pellicer *et al.*, 2012; Warren, 1991) and glaciolacustrine sediments (Delaney, 2007; van der Meer & Warren, 1997) within the catchments of the Brosna, Little Brosna, Inny and Suck rivers in central Ireland. However, there remains underutilised potential for detailed paleoenvironmental reconstruction offered by glaciolacustrine sediment archives within this area.

To address this gap this project sampled glaciolacustrine sediments deposited in Paleolake Riada and preserved under the cut-over peat bog at Galros East Co. Offaly, Ireland (Fig. 1). This site was selected based on the following parameters:

1. A locality within the reconstructed extent of Paleolake Riada that remained submerged for a maximum length of time to allow for the longest continuous record to be extracted.
2. Proximity to glaciofluvial ice marginal features that allow a paleoenvironmental reconstruction to be linked to existing and future models of ice margin position through proximity to glaciofluvial ice-marginal features.
3. A site with a preserved record of glaciolacustrine sediments that is suitable to be sampled with a Russian corer, i.e., not overlain by thick beds of sand or gravel.

**Figure 1.** Location of the Galros East site and associated glacial geomorphology (*Geological Survey Ireland*).







**Figure 2.** Example core containing laminated silt and clay extracted from Galros East co. Offaly, Ireland

The area surrounding Birr, Co. Offaly was identified as meeting criteria one and two due to reconstructed extents of Paleolake Riada and the identification of sub-aqueous glaciofluvial ice-marginal features in the form of delta and subglacial conduit outflows at Birr (Delaney *et al.*, 2018; Gallagher *et al.*, 1996).

The initial aim of the fieldwork funded by the NRW was to investigate the third criterion by sampling the sediments underlying the peat cover that makes up much of the land surface in this area. With a suitable site identified through exploratory work, a set of cores could then be extracted and transported to the labs at Manchester Metropolitan and the University of Manchester.

Some limitations to this exploratory work were posed by ongoing peat extraction limiting access to sites, particularly to the immediate northeast of Birr. However, gauge auger coring at Galros East, 5 km to the north of Birr, revealed thick (> 10 m) beds of laminated silts and clay indicative of a glaciolacustrine environment (Fig. 2). The presence of calcareous marl overlying these sediments also indicated the area remained subaqueous through deglaciation and into Holocene climate amelioration, assuming the sequence records continuous deposition.

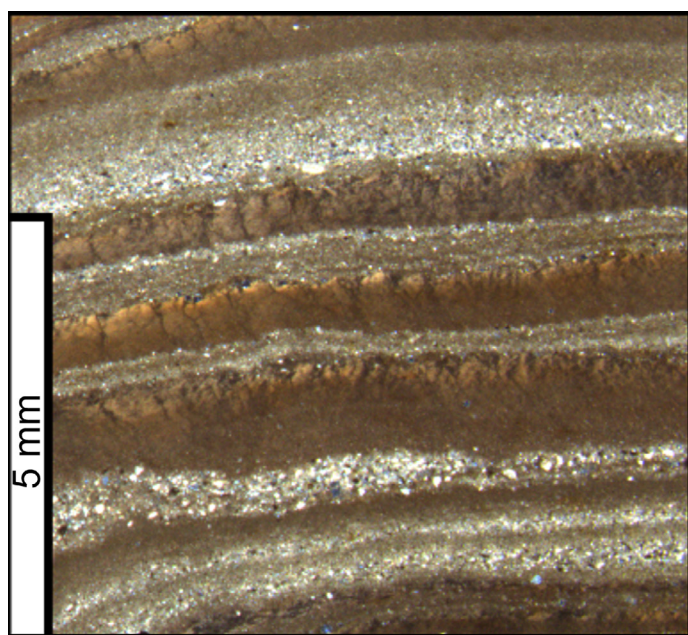
With Galros East identified as a suitable site, three sets of overlapping cores were taken with a Russian corer. The maximum depth reached by this sampling was 12.5 m where deeper sampling was prevented by angular pebbles of local limestone of up to 5 cm in length (Fig. 3), likely indicating subglacial or immediately ice proximal conditions.



**Figure 3.** Basal sediments of the Galros East Sequence composed of pebbles and granules in a silt matrix

The sediments extracted from the site were then transported back to Manchester for analysis. Particle size, ITRAX  $\mu$ -XRF, sediment logging, and thin section analysis were applied to describe and characterise the sediments. The characteristics of this sequence then allowed for a paleoenvironmental reconstruction of Lake Riada at this site. The basal

sediments record deposition in a high-energy ice proximal environment indicated by coarser-grained material in the form of pebbles, granules, and sands and the deformation of sedimentary structures through folding and faulting. Up sequence, a fining of particle size alongside increased preservation of thin fine-grained laminae (Fig. 4), including annually laminated units, demonstrate a transition to quiescent lakebed conditions. This is also reflected in the geochemistry of the sediments by indicators of deoxygenated conditions via redox-related element ratios such as Fe/Mn. Overlying the minerogenic laminated silts and clays are up-sequence increasingly organic-rich sediments eventually transitioning into the organic-rich calcareous marl which contains a high abundance of gastropod shells and plant matter.



**Figure 4.** Thin section example of thin rhythmites deposited in Paleolake Riada

In conclusion, the fieldwork undertaken in the Irish Midlands funded by NRW was successful and met the proposed aims of this work. A long (12.5 m) continuous sedimentary record of Paleolake Riada Glaciolacustrine conditions was extracted from beneath the peat bogs within the mapped extent of the lake. Proximity to subglacial and ice-marginal features allows this reconstruction of conditions during deglaciation to be placed within the context of existing and future models of the deglaciation of central Ireland.

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