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Reconstructing Ice Dynamics During the Last Glacial Termination Using Rhythmically Laminated Glaciolacustrine Sediments

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Rhythmically laminated silts and clays are common in glaciolacustrine sediments. When these are annually laminated (varved) the sediments can be used to reconstruct the timing of glacial and meltwater dynamics, including ice advance and retreat and lake drainage events. However, distinguishing rhythmites formed by seasonal variation – annual rhythmites or varves – is difficult, as similar rhythmites may form due to density currents and sub-annual variation.

This study presents sedimentological analysis of rhythmically laminated silt and clay couplets in glaciolacustrine silts and clays from proglacial, ice-dammed Paleolake Riada, central Ireland, that formed during the Last Glacial Termination after 21,000 BP. A combination of microscale sedimentological logging and micromorphological analysis of structures using scanning-electron microscopy and thin sections was used to describe and classify different couplet types. Couplets from the lower part of the lake sequence, found in the central part of the basin, display complex patterns of sub-millimetre lamination within both silt and clay units, and considerable variability in thickness of both silt and clay units. Microfacies analysis indicates multiple deformation structures indicative of high pressure gradients and lateral shear, interpreted as evidence for ice readvance into the lake. However, couplets from the highest part of the sequence have characteristics consistent with seasonal sedimentation, including laterally continuous clay laminae with sharp lower and upper boundaries (characteristic of deposition as winter layers), and multiple sub-laminae within silt laminae, consist with deposition from a range of inputs over summer. These changing temporal patterns have implications for shifting ice dynamics and associated meltwater input into the lake during overall ice sheet recession.