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The sedimentary evolution of the Celtic Sea during Marine Isotope Stages 1 and 2

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During the Last Glacial Maximum (LGM), the Celtic Sea was partially glaciated by the Irish Sea Ice Stream and is considered to have subsequently experienced a high-energy post-glacial transgression. The combination of these events resulted in the deposition, reworking and erosion of a wide range of sediment types to produce the upper stratigraphy of the shelf, including the world's largest submarine elongated ridges. These geomorphic features dominate the shelf and have been previously interpreted to have formed as a result of the tidal reworking of shelf deposits during transgression, despite not having been directly dated. Shelf-wide high-resolution geophysical data, and vibrocores, collected as part of the BRITICE-CHRONO Project, provide new information on relationships between seismic and shallow sedimentary units. A regionally extensive near-surface reflector, cored in several locations, correlates to a gravel\shell layer with an erosive base, unconformably overlying fine-grained LGM glacial sediments with undrained shear strengths in excess of 120 kPa, and in places exhibiting visibly deformed laminations. Geotechnical tests suggest these sediments to be over-consolidated, and we propose that these properties and the observed deformation can only be explained by subglacial reworking under a re-advancing Irish Sea Ice Stream, a scenario never before evidenced in reconstructions of Celtic Sea glaciation. Previous reconstructions propose a single advance-retreat cycle; therefore, a re-advance during a time of inferred retreat would represent a significant change in glacial dynamics. Seismic reflection profiles show that the regionally continuous gravel\shell layer appears to form an undulating palaeo-topography, possibly influenced by the geotechnical properties of the deposits below, on which the large surface ridges are formed. The presence of a regionally continuous reflection surface truncating LGM glacial sediments would suggest a significant erosion event after glacial deposition occurred, possibly representing transgression. This suggests that the large surface ridges may be of post-glacial tidal origin, but with significant sediment supply and morphological control influenced by the glaciation of the Celtic Sea.