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Seeking the seaward limits of the Irish Sea Ice Stream: glaciation of the Celtic Sea and first results from the GATEWAYS II campaign

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The dynamics of the last British-Irish Ice Sheet (BIIS) are thought to have been strongly influenced by the activity of marine-based ice streams, the largest of which flowed down the Irish Sea and, at maximum, onto the broad continental shelf of the Celtic Sea. However, the maximum extent of the Irish Sea Ice Stream (ISIS) remains unclear: subglacial tills and glaciomarine muds recovered in BGS vibrocores from the Irish-UK sectors have been used to propose a mid-shelf grounding line, but subglacial or ice-proximal sediments have also been cored at two sites near the shelf edge over 100 km to farther seaward. The glacigenic sediments were cored between, but in places from the flanks of, a vast system of shelf-crossing seabed ridges (up to 55 m high, 7 km wide and 300 km long) that fan seaward from the northern Celtic. The ridges have traditionally been interpreted as moribund tidal sand banks formed during the post-glacial marine transgression, albeit overridden in the NW by the last ice sheet. An alternative explanation is that they are glaciofluvial landforms, recording meltwater drainage beneath beneath an ISIS that extended to the shelf edge. The glacigenic succession on and between the ridges has been investigated through the acquisition of multibeam imagery and subbottom profiles during the Italian-led GLAMAR and Irish-led GATEWAYS I campaigns (2009, 2012), which targeted the key BGS vibrocores used to propose a mid-shelf grounding line. Results indicate subglacial tills and glaciomarine muds to extend across the ridges, forming distinctive transform bedforms (ribs) that extend at least 60 km seaward of the proposed grounding line. The rectilinear network of ridges and transverse ribs are tentatively interpreted as giant eskers flanked by glaciofluvial De Geer moraines, a hypothesis with implications for both the extent and the dynamics of the ISIS. This hypothesis is to be further tested during the GATEWAYS II campaign of the Celtic Explorer in February-March 2014, which will acquire new precisely positioned vibrocores and seabed samples, as well as complementary geophysical data, targeting study areas on the mid- to outer shelf. The results are intended to provide a critical test on our understanding of the extent and dynamics of the last BIIS.