



## **The last British-Irish Ice Sheet in the southern North Sea: ice limits, timing and the influence of the Dogger Bank**

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The southern North Sea is a particularly important area for understanding the behaviour of the British-Irish Ice Sheet (BIIS) during the last glacial cycle. It preserves a record of the maximum extent of the eastern sector of the BIIS as well as evidence for multiple different ice flow phases and the dynamic re-organisation of the BIIS. This paper explores the origin and age of the Dogger Bank (DB); re-assesses the extent and age of the glaciogenic deposits across the shallow areas of the North Sea adjacent to the Dogger Bank and; re-examines the dynamic behaviour of the BIIS in the southern North Sea between 30 – 19 ka.

The DB is composed predominantly by glaciolacustrine sediment deposited between 31.6 – 25.8 ka. Following its formation the western end of the Dogger lake was overridden with initial ice override and retreat northwards back across the Dogger lake complete by 23.1 ka. This resulted in widespread compressive glacio-tectonism of the lake sediments and the formation of thrust moraine complexes. Along the northern edge of the DB, moraines are on-lapped by later phase glaciolacustrine and marine sediments but do not show evidence of subsequent ice override.

The seafloor to the west/southwest of the DB records several later phases of ice advance and retreat as the North Sea Lobe (NSL) flowed between the DB and the Yorkshire/Lincolnshire coast. New OSL ages limit the arrival of the BIIS on the Norfolk coast to 22.8 – 21.5 ka, after which multiple till sheets and moraines on the seafloor mark northwards retreat of the NSL. This pattern of behaviour is broadly synchronous with the terrestrial sedimentary record along the Yorkshire coast which relates to post Dimlington Stadial NSL oscillation and retreat (~ 21.5 ka)

With respect to forcing mechanisms it is likely that during the early phases of the LGM (~30-23ka) the interaction between the southern margin of the BIIS and the Dogger Lake was critical in influencing flow instability and rapid ice advance and retreat. However, during the latter part of the LGM (22 - 21 ka) late-phase ice advance in the southern North Sea became restricted to the western side of the DB which was a substantial topographic feature by this time. This topographic confinement, in addition to decoupling of the BIIS and the Fennoscandian Ice Sheet further north, enabled ice to reach the Norfolk coast, subsequently overprinting the seabed with late-phase tills of the Bolders Bank Fm.