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Postglacial landscape evolution during rapid marine transgression at Dogger Bank, North Sea

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Dogger Bank, in the southern North Sea, experienced marine transgression during rapid postglacial relative sea-level rise in the Holocene. This period of relative sea-level rise and corresponding marine flooding provides an excellent analogue to study the effects of future sea-level rise on coastal realignment and inundation processes. A dense grid of 2D seismic reflection data and vibrocores acquired for the Forewind windfarm project provide a unique, high-resolution dataset to study these process interactions.

Integration of the seismic and core data have shown the presence of glaciotectonically-deformed diamicts, proglacial lake deposits and glaciofluvial sandur plain sediments from the Last Glacial Maximum and later cold climates. Subsequent, rapid postglacial sea-level rise into the Holocene produced a transgressive coastal succession overlying the glacial sediments, from salt marsh, through intertidal flat with occasional sands, to shallow marine sands. This dataset supports development of a beach barrier environment, with the salt marsh and tidal flats present landward of the barrier, with distinctive coarse-grained event beds that mark occasional storm events and potentially Storegga tsunami deposits. Barrier overstepping is observed in the seismic reflection data and within the cores. Wave ravinement truncated the overstepping barriers, with subsequent deposition of a transgressive gravel lag and bioturbated shallow-marine sands through to recent times.

A previously published sea-level index point from the salt marsh peat constrains the local transgression to after 9130 $\pm$ 137 cal BP. Sea-level “jumps” such as the jump prior to the 8.2 ka cooling event may have doubled the background rate (10 m/kyr) of sea-level rise, although few constraints exist. Coastal morphology and evolution at Dogger Bank may also have been strongly influenced by tidal range and antecedent paraglacial topography. Further seismic mapping and core logging will reveal the high-resolution landscape evolution of Dogger Bank during transgression. The role of rapid sea-level rise and sediment supply in the overstepping and in-situ drowning processes will be constrained, helping to disentangle the interplay of processes and landform preservation during transgression, which can be applied to ancient systems, and for future coastal protection strategies.