A geological characterization of the Sørlige Nordsjø II offshore wind site, southern North Sea

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Shallow subsurface and seabed deposits in previously glaciated marine areas are highly heterogeneous, representing a range of glacial and post-glacial environments and processes including glacitectonism, over-consolidation, fluvial and lacustrine deposition, and transgression. These heterogeneities are often linked to variations in geotechnical properties, with important implications for the design and installation of offshore wind infrastructure, and for data acquisition strategies.

Here, we present an integrated geological characterization of the Sørlige Nordsjø II offshore wind site, located in waters of 50-70 m depth along the southern border of the Norwegian North Sea. We focus on the evolution of the area's depositional setting during the Late Quaternary period and its implications for offshore wind development. We also integrate interpretations from a marine geological dataset acquired in 2022 with legacy 3D seismic data and a review of the current understanding of the southern North Sea's complex glacial history.

Five main geological units within the shallow subsurface, summarized within a preliminary conceptual geological model, are identified: 1) homogeneous and layered marine sands covering most of the site, with patchy distribution and coarser-grained deposits in the east, 2) buried, layered channel deposits containing organic material and possible associated shallow gas, 3) buried, stiff glacilacustrine clay deposits, 4) a buried, layered, glacitectonized unit incised by tunnel valleys, with a sandy marine infill, and 5) mounded glacial tills and glacitectonized deposits containing boulders, exposed to shallowly buried in the east. Salt diapirism and gas migration were also found to be important potential geohazards at the site.

3D seismic attribute maps were found to be a powerful aid to understanding the distribution and genesis of seismic facies identified on 2D high-resolution sub-bottom profiles. This type of data integration is an under-utilized methodology for generating detailed preliminary ground models, which can inform more cost-effective site survey and early foundation concept planning at geologically complex offshore wind sites.