Quaternary sediments of the southern North Sea – core analyses in aid of paleo-reconstructions. A case study of the Brown Bank, The Netherlands

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The Brown Bank (BB), a sand ridge located midway between the Dutch and British coastlines of the southern North Sea, is a site of interest thanks to the recovery of archeological and paleontological material, including tools, human remains, etc., of Mesolithic age (10–7.5 ka BP) (Peeters & Amkreutz, 2020; Missiaen *et al.*, 2021). They were found *ex situ* by e.g. dredging a large area, which emphasizes the need to advance paleo-landscape research to pinpoint areas of archeological potential, where these artifacts could be retrieved *in situ* (Missiaen *et al.*, 2021).

This master thesis research combines ultra-high-resolution parametric echosounder sub-bottom profiler (PES) and core data obtained during several surveys (2018–2022). Core data include lithological descriptions, multi-sensor core logging (MSCL) data (density and magnetic susceptibility), micropaleontological analyses of pollen, ostracods, foraminifers and diatoms, as well as optically stimulated luminescence (OSL) and radiocarbon dates. Interpretation of this dataset yields four acoustic units (AU), which represent eleven lithological units (LU). Paleoenvironmental analysis of the fossil content and correlation between cores further aid in determining the environmental evolution of the BB area.

During past glacial periods (e.g. the last glacial MIS4-2), sea levels were globally more than 100 m lower than today, with the southern North Sea subaerially exposed and consisting of a low-lying area in which large rivers coalesced and drained the European continent. Around 11–9.5 ka, based on ^{14}C-dates, rising groundwater levels, caused by rising sea level, led to freshwater peat development in vegetated slow- flowing and stagnant water bodies, along with deposition of organic-rich sands. Previously analyzed pollen data indicate pine trees prevailing in a marsh environment, with increasing amounts of deciduous trees. Around c. 9.5 ka, two small sandy, dominantly freshwater deposits with a small brackish signal in the diatom composition, hint to a first phase of tidal influence in these rivers. Shortly after, fine laminae of clay and fine sand and brackish microfossils indicate widespread estuarine tidal flats, creeks and shallow rivers until c. 8.5 ka. The approaching coastline is marked by an increase in salinity and depositional energy. For this period, the pollen data indicate the presence of marsh conditions at the edge of a pine, elm, oak and hazel forest. After a period of erosion, from c. 8 ka onwards, shelly sands indicate high-energy marine conditions.

Some important conclusions and hypotheses result from this reconstruction. (1) The presence of dominantly freshwater deposits above the peat layer has hitherto not been described in the literature. Their origin requires more research. A possible explanation is an estuarine system comparable to that of the river Scheldt (Belgium) today, where the tidal influence reaches far inland, but with predominantly fresh environmental conditions. (2) The freshwater peat can be used as a limiting point for sea-level reconstructions. (3) Preliminary mapping of the tidal sediments suggests a complex channel network. Its orientation allows to hypothesize that the first marine influence entered the area from estuaries north of the BB area. (4) From our acoustic data, there appears to be no indication that the BB was already a topographic upstanding feature during the Mesolithic, as suggested by Missiaen *et al.* (2021).

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