

Geological built-up and sediment distribution of Amrum Bank (North Sea)

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The German part of the North Sea inner shelf north of the Elbe river is still poorly understood regarding its postglacial evolution. Most investigations have been undertaken in the context of coastal protection, sediment mobility [1] and sand resources [2]. As a consequence, little is known about the geological development from the late glacial to the present and the response of the coastline to sea-level fluctuations confirmed by age control. Furthermore, index points for the Holocene relative sea-level rise do not exist for this area [3].

Amrum Bank is a shoal in the North Sea located 55 km offshore Schleswig Holstein. It is a wave-dominated, mesotidal environment covering approx. 150 km² and extending from -22 m to -8 m SKN (German marine chart datum). Due to its shallowness and rough hydrological conditions, the bank has received little attention in the past. Previous extensive research activities took place in the early 1970s [1]. These provided preliminary data on its geological built-up, which is characterized by a Pleistocene core covered by Holocene deposits of variable thickness [1, 2]. In 2014/15, new geological investigations on Amrum Bank included 3945 km of full side-scan sonar coverage and high-resolution seismic profiling, 200 grab samples and 19 vibrocores up to 3 m in length.

The uppermost lithological unit of Amrum Bank has thicknesses ranging from only 20 cm to 1 m. It is mainly composed of sand deposited during the late Holocene. Below this layer a sediment body of up to 35 cm in thickness consists of coarse-grained, mainly gravelly material, denoting a transgressive horizon. Depending on the water depth, a variety of different lithological units can be recognized below this transgressive lag deposit. These units represent former low-energy tidal flat deposits, as indicated by flaser-bedding structures, terrestrial deposits such as peat, Weichselian melt water sands or remnants of glacial deposits.

The surface sediments on Amrum Bank are characterized by medium to coarse sands. Large-scale elongated sedimentological/geomorphological structures composed of coarse sand with lengths of more than 7 km and widths of 5–90 m are incised into the sediment covering the seafloor, indicating the presence of sorted bedforms. These sedimentological structures are located on morphological elevations and represent windows in the surface sediment cover exposing the underlying transgressive lag sediments. When compared with multibeam backscatter data from 2005 [4], these surficial sediment structures and seafloor morphologies indicate a long-term stability of at least 10 years.

References:

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