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A multi-proxy chronological reconstruction of palaeosalinity in the eastern Limfjord, Denmark

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The Jutland peninsula in northern Denmark is home to the Limfjord, one of the largest estuarine bodies of water in the region. Human inhabitance of the Limfjord's surrounding coastlines stretches back further than 7,800 cal BP, with anthropogenic influence on the landscape beginning approximately 6,000 cal BP. Understanding how the Limfjord as a system has changed throughout time is useful in comprehending subsistence patterns and anthropogenic influence. This research is part of a larger project aimed at discerning subsistence patterns and environmental change in the region. Following the Younger Dryas, as the Fennoscandian ice sheet began to melt, Denmark experienced isostatic rebound, which contributed to the complex sea level history in the region. Between ice melt and isostatic rebound, the Jutland peninsula experienced many transgression and regression events. Connections to surrounding seas have shifted throughout time, with most attention focused on the western connection of the Limfjord with the North Sea, which has experienced numerous closures and subsequent re-openings throughout the Holocene. Furthermore, the Limfjord-North Sea connection has been the focal point of research because of the west to east water flow in the system, and the present day higher salinity in the west compared to the east. Little to no consideration has been paid to the influence of the Kattegat and Baltic on the Limfjord until now. A 10m sediment core was taken from Sebbersund (near Nibe, Limfjord), along the connection between the Limfjord and the Kattegat in the east to understand how the eastern part of the system has changed and differed from changes observed in the west. The Sebbersund sequence spans a majority of the Holocene, from 9600 cal BP to 1030 cal BP, determined via radiocarbon dating of terrestrial macrofossils and bulk sediment. Over this time period palaeoenvironmental conditions were reconstructed through the use of geochemical analyses (δ13C, δ15N, C:N), physical sediment analyses, dinoflagellate cyst abundances and molluscan analyses. Apart from two instances of low salinity, one at the top and one at the bottom of the core, the sequence has a strong marine signal for a majority of the Holocene. Radiocarbon dating of bulk sediment samples showed the presence of old carbon in the system, creating an age offset between 1,300 $\pm$ 200 and 2,800 $\pm$ 200 calibrated 14C years compared to the age-depth curve based on the terrestrial macrofossils. This finding, along with the strong marine influence in the system, discerned through geochemical data, dinoflagellate cyst and mollusc counts, is important for obtaining accurate radiocarbon ages in the region and stresses the importance of understanding both the marine and freshwater reservoir effects. The marine dominance in the eastern Limfjord differs from the west, which is characterized by a number of freshwater events when the North Sea connection was closed off during the Holocene. The eastern connection was open to the Kattegat throughout a large portion of the Holocene, with influx of open ocean water entering the system during periods of higher sea level.