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Coastal lagoon systems as indicator of Holocene sea-level development in a periglacial soft-sediment setting: Samsø, Denmark

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Confined shallow-water environments are encountered many places along the coast of the inner Danish waters. Despite their common occurrence, these environments have rarely been studied as sedimentary archives. In this study we set out to trace back changes in relative sea-level and associated geomorphological responses in sediment cores retrieved from coastal lagoon systems on the island of Samsø, central Denmark.

In the mid-Atlantic period, the post-glacial sea-level rise reached what is today the southern Kattegat Sea. Waves, currents and tides began to erode the unconsolidated moraine material and melt-out deposits. This initiated sedimentation in adjacent coastal lagoons and further supported the formation of coastal barriers. Until present day, the ongoing isostatic uplift caused a continuous drop of relative sea-level resulting in shoreline accretion and successive lagoonal infilling.

Stratigraphy, grain-size distribution, fossil and organic matter content of cores retrieved from the lagoons were analyzed and compared. Age control was established using radiocarbon and optically stimulated luminescence dating.

Our data produced a surprisingly consistent pattern for the sedimentary successions found in the lagoons. The period of initial transgression can be identified as the onset of deposition of fine-grained, organic-rich sediments. However, radiocarbon dates evidence a punctuation of these deposits further upcore. Grain-size analysis suggests that the reworking and abrasion of the lagoon sediments resulted from the gradual lowering of the wave-base. The core sequence is topped-off by marine sands and wind-blown deposits. Based on these findings, we suggest a conceptual model that allows inferring age and elevation of transgressive and regressive stages from the lagoon cores.

The common occurrence of similar environments distributed along gradients of isostatic uplift/subsidence (approximately +0,5 to -0,5 mm/yr) in the south-western Baltic, makes coastal lagoon systems a valuable archive for the reconstruction of Holocene sea-level and coastal evolution.