

Challenges of Holocene sea-level reconstructions in area of low uplift rate

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Isolated coastal water bodies provide an excellent sedimentary archive of the evolutionary stages of the coastal regions. It is relatively easy to determine lake isolation threshold, time and contact, where marine and brackish diatoms are replaced by halophilous and subsequently by freshwater diatoms, in areas with high land uplift rates and hard bedrock. Whereas, in areas where the land uplift rate is near zero and sedimentary cover of sand, silt and/or clay exists, determination of the lake isolation threshold and time is a rather complicated task. Such an area is the coast of the Gulf of Riga, where the apparent land uplift is about 1 mm yr^{-1} in the northern part and near zero in the southern part of the area.

The aim of the study is to improve the understanding of the nature and extent of the Holocene sea level changes in the eastern Baltic Sea region, in the area with low land uplift rate. This study marks the first attempt to reconstruct sea level changes for a wide variety of settings based on high-resolution bio-, litho-, and chronostratigraphical evidence from sediment records of isolation basins in Latvia.

In total, eight lakes were studied in order to revise the relative sea level (RSL) changes at the southern coast of the Gulf of Riga based on new litho- and biostratigraphical data and radiocarbon datings. The palaeogeographical reconstruction was challenging because we had to take into account that the process of isolation was influenced by various factors, such as gradual eustatic sea level (ESL) rise, river delta infilling by sediments and long-shore sediment transport.

The water level in the Baltic Sea basin until 8,500 cal BP was influenced primarily by deglaciation dynamics, whereas in the last 8,500 years, the main factor was complicated interplay between the ESL rise and the land uplift rate. According to diatom composition and radiocarbon dates, the Litorina Sea transgression was a long-lasting event (ca. 2,200 years) in the southern part of the Gulf of Riga. It culminated more than 1,000 years later compared with sites with higher uplift rates in the northern part of the Baltic Sea. At the southern coast of the Gulf of Riga the Litorina Sea level reached close to the present sea level at 5,000–4,200 cal BP. On the basis of the obtained results and GIS analysis, palaeogeographical maps for various time windows were compiled.

In this study the multi-proxy approach was used, by applying high resolution studies of wide settings of isolation basins, to obtain new evidence of RSL changes and patterns of land uplift. This study can serve as the basis for further investigations in other areas along the coastline of the eastern Baltic Sea. Moreover, it may help to provide answers to unclear questions about the future.