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## „Indecent“ witnesses: Using faecal lipids to reconstruct human population growth in the Baltic Sea region

*What rivers carry into the Baltic Sea usually ends up in one of its deep basins. Year after year, sediments are thus formed, piling up on top of each other over centuries and millennia. Geologists find so-called proxies in these deposits – evidence they use to reconstruct earlier environmental conditions. In a paper now published in the journal “Environmental Research”, Jérôme Kaiser from the Leibniz Institute for Baltic Sea Research Warnemünde (IOW) and Mathias Lerch from the Max Planck Institute for Demographic Research show that population development and wastewater history in the Baltic Sea region can also be reconstructed in this way – with the help of the remains of faeces!*

To make it clear from the start: No, the Baltic Sea is not a cloaca. A lot of sewage treatment plants along its coast take care of the purification of the waste water and what the rivers then still carry into it is highly diluted. Nevertheless, in the sediments at the bottom of the Baltic Sea, molecules can be detected in extremely low concentrations that definitely represent elements of faecal matter. For geoscientists like Jérôme Kaiser, these “indecent” molecules are as valuable as gold dust. As witnesses in the archives of the Baltic Sea, they provide information on population growth and the development of sewage pollution in the Baltic over the past centuries.

“We determine lipids in the sediments that are characteristic of human faeces, but also of excrement from farm animals,” explains Jérôme Kaiser, head of the biomarker laboratory at the IOW. In a large-scale study, he examined the amount of faecal lipids in the sediments of some important Baltic Sea tributaries as well as the surface sediments in different basins of the Baltic Sea. “The levels of faecal lipids in the sediments of the rivers differ greatly. Rivers with large cities or intensive livestock farming in their catchment areas show the highest levels.” Kaiser also found these patterns in the surface sediments of the Baltic Sea: The highest levels were found near the mouths of polluted rivers or where regular currents carry their water. He is convinced: “This method has the potential to serve as an indicator of eutrophication.”

In addition to identifying spatial differences, the authors also succeeded in pinpointing temporal differences: Sample material from a sediment core was available from the northern Gotland Basin (Central Baltic Sea). An age dating assigned the sediments to a time span from 1867 to 2015. During this time, the proportion of faecal matter increased steadily, with a mixture of human and livestock faecal matter always present. The highest proportions of human faeces occurred in the 1950s, the late 1980s, and the 2010s.

To determine if there was a link between the recorded levels of faecal lipids and population growth, the values were compared to demographic data from the Baltic region. This revealed parallels with population trends in the south-eastern Baltic region. Especially clear were the similarities with the development in the St. Petersburg area. For Jérôme Kaiser, this opens up interesting possibilities for looking into even earlier times. “We know that these molecules remain stable in the sediment



for quite a long time. We can use them, for example, to get more information about population dynamics at the time of the Medieval Warm Period.” And demographer Mathias Lerch adds, “The faecal lipids broaden the range of tools we use to reconstruct past environmental conditions with the opportunity to consider in parallel the population dynamics. This allows thrilling insights into potential interactions between the environment and the population in the past.”

**Original scientific publication:**

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