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Sediment trace metals as a recorder of bottom water redox conditions in the Baltic Sea over the Holocene

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Increased inputs of nutrients from waste water and fertilizer have driven enhanced algal growth in the surface waters of the Baltic Sea over the past century. The sinking of this organic matter to the seafloor and subsequent decay has led to an oxygen demand in the bottom water that outpaces oxygen supply. Water column records indicate that this has resulted in a major redox shift in bottom water conditions from oxic to sulfidic (euxinic) in the late 1970's and early 1980's. Here, we show that this redox shift is recorded in sediment trace metal records throughout the Baltic Proper. We demonstrate that while rhenium (Re) tracks suboxia, molybdenum (Mo) is an accurate indicator of euxinia in the Baltic Sea.

We subsequently use sediment Mo data for two long cores to assess changes in redox conditions over the Holocene. At one site, our results confirm earlier work showing three distinct periods of bottom water euxinia, namely during modern and medieval times and the early Holocene. The second site, in contrast, was euxinic throughout most of the Holocene. We suggest that the variable trends in redox observed at the first site are representative for most of the Baltic Proper and long-term bottom water euxinia in the Baltic Sea is limited to several small restricted basins.