

# A Holocene history of dynamic redox conditions in the Landsort Deep, Baltic Sea

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Few attempts have been made to define past intervals of natural Baltic oxygen depletion in an integrated context spanning the large range of water column redox conditions observed in the Baltic today (oxygenated, vacillatory, manganous, euxinic). Here, using the highest resolution Baltic Holocene record to-date at Landsort Deep, captured during IODP Expedition 347, and a combined Fe-Mn-Mo approach, we specifically define the degree of past oxygen depletion. Iron geochemistry confirms that two sapropel units were deposited under anoxic bottom waters (Anoxic Intervals 1 and 2; AI-1 and AI-2). Both Fe-speciation and Mo concentrations (>100 ppm) indicate euxinia during AI-1 and vacillating euxinic and ferruginous bottom waters during AI-2. Molybdenum isotope data confirm that sedimentary Mo delivery during AI-1 was maintained by persistently albeit weakly euxinic conditions—in contrast to a combination of Mn/Fe oxide hosts and weak/transient euxinia during AI-2. Indeed, extreme Mn enrichments (10-15 wt. %) and appreciable non-pyritic Fe in AI-2 relative to AI-1 indicate an anoxic background with accumulation of dissolved Mn and Fe buried as oxides during periodic oxygen flushing events. Today, Landsort Deep is characterized by weakly euxinic conditions stable on decadal timescales<sup>1</sup>, seemingly similar AI-1. This comparison suggests that, more similar to modern weakly stratified Baltic sub-basins<sup>1</sup>, redox variations during AI-2 occurred on shorter time scales with a lower reducing potential than during other anoxic intervals at Landsort Deep.

<sup>1</sup>Carstensen et al., (2014) *PNAS* **111**, 5628-5633.