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Holocene benthic responses to saline water inflows to the Baltic Sea - INFLOW project

Joonas Virtasalo and Aarno Kotilainen
Geological Survey of Finland, Finland

The INFLOW project uses sediment multi-proxy studies and modelling to 1) identify the forcing mechanisms of palaeoenvironmental change of the Baltic Sea over the past 6000 years, and 2) to provide selected scenarios of the future Baltic Sea. In contrast to previous studies, INFLOW studies changes in both surface and deep water conditions (e.g. saline water inflow, hypoxia and temperature) and their timing by means of multi-proxy studies combined with state-of-the-art modelling approaches. INFLOW uses high-resolution sediment proxy data from key sites along a transect from the marine Skagerrak to the freshwater-dominated northern Baltic Sea.

The Baltic Sea environment is strongly influenced by the episodic inflows of saline water from the North Sea which enter the basin as dense near-bottom currents that provide the most important means of transporting oxic water to the oxygen-poor deep areas of the Baltic Sea. Studying the sedimentary records of these inflows has been hindered by the low abundance and poor preservation of benthic taxa in those sediments. Yet, novel integrated sedimentological and ichnological methods and concepts developed in INFLOW are useful for constructing records of benthic responses to the changing deep water (oxygen) conditions in several sub-basins of the basin (Virtasalo et al., 2011). The anoxic background conditions with no burrowing macrofauna in the Baltic Sea deeps are recorded as laminated sediments. With increasing oxygen availability (inflow activity), the sediment surface is biodeformed by nectobenthos-dominated community. Further increase in oxygen availability permits colonization by the burrowing macrofauna, whose activities are recorded in the sediments as identifiable burrow structures (trace fossils, predominantly Planolites with rare Arenicolites/Polykladichnus) and bivalve biodeformation structures.

The records of laminated, biodeformed and burrow-mottled sediment intervals reveal more dynamic and oxic depositional conditions in the Baltic Sea deeps than previously thought. The biodeformed interbeds within the long laminated intervals imply that the commonly held view of these intervals as indicative of extensive periods (several millennia) of continuous hypoxia is an oversimplification. The high-resolution temporal reconstructions of benthic variability in several Baltic Sea sub-basins with respect to the Holocene climate variability will be presented at the conference.

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References

Virtasalo, J.J., Leipe, T., Moros, M., Kotilainen, A.T. 2011: Physicochemical and biological influences on sedimentary-fabric formation in a large, salinity and oxygen-restricted epicontinental basin: Gotland Deep, Baltic Sea. Sedimentology, in press.