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Iron oxide reduction in deep Baltic Sea sediments: the potential role of anaerobic oxidation of methane

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Methane is a powerful greenhouse gas and its emission from marine sediments to the atmosphere is largely controlled by anaerobic oxidation of methane (AOM). Traditionally, sulfate is considered to be the most important electron acceptor for AOM in marine sediments. However, recent studies have shown that AOM may also be coupled to the reduction of iron (Fe) oxides (Beal et al., 2009; Riedinger et al., 2014; Egger et al., 2014). In the Baltic Sea, the transition from the Ancylus freshwater phase to the Littorina brackish/marine phase (A/L-transition) ca. 9-7 ka ago (Zillén et al., 2008) resulted in the accumulation of methanogenic brackish/marine sediments overlying Fe-oxide rich lacustrine deposits. The downward diffusion of methane from the brackish/marine sediments into the lake sediments leads to an ideal diagenetic system to study a potential coupling between Fe oxide reduction and methane oxidation.

Here, we use porewater and sediment geochemical data obtained at sites M0063 and M0065 during the IODP Baltic Sea Paleoenvironment Expedition 347 in 2013 to identify the potential mechanisms responsible for the apparent Fe oxide reduction in the non-sulfidic limnic sediments below the A/L transition. In this presentation, we will review the various explanations for the elevated ferrous Fe in the porewater in the lake sediments and we will specifically address the potential role of the reaction of methane with Fe-oxides.

References:

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