The influence of long distance electron transport on carbonate dynamics in sediments and benthic-pelagic coupling

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It has recently been proposed that the pH distribution in coastal sediments can be altered by filamentous sulfide oxidizing bacteria responsible for long distance electron transport (LDET), coupling spatially separated redox half-reactions. In this study, we examined the temporal development of LDET in incubations with sediments from organic-rich, muddy deposits in the deeper gullies of Lake Grevelingen, a coastal impoundment in the SW Netherlands, where hypoxia occurs in spring and summer and LDET has been recently observed.

The vertical distribution and benthic fluxes of oxygen, nutrients, pH, alkalinity, calcium, iron and sulfur were determined in incubations of homogenized sediments over a period of 13 weeks in order to examine the influence of LDET on sediment biogeochemistry and benthic-pelagic coupling. The development and decline of LDET, indicated by a characteristic vertical porewater pH distribution, was coincident with a rise and fall in oxygen consumption and alkalinity production rates in sediments. These results have important implications with respect to the recovery of coastal ecosystems from hypoxia and links between oxygen depletion and acidification, which often coincide.