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Controlling factors on methanogenesisin the deep sediment of Lake Kinneret

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The main pathways of methane production (methanogenesis) are through fermentation of acetate (acetoclastic methanogenesis) and through CO_2 reduction with hydrogen (hydrogenotrophic methanogenesis). In most freshwater environment the dominant pathway is through acetoclastic methanogenesis, while in marine sediments the main pathway is through CO_2 reduction. Another minor pathway of methane production is through methylotrophic methanogenesis with noncompetitive substrate like methylamine etc.
This study investigates the controlling parameters on methanogenesis in deep lacustrine sediments and their link to methanotrophy process. Our findings suggest that in Lake Kinneret (Israel) sediments (Station A, 38 m depth), methanogenesis is restricted to a zone between 3 and 25 cm depth and ends abruptly. This is based on a model calculation and slurry incubation experiments. Below this zone there is a sink for methane, and sets of geochemical data show that this methane sink is related to anaerobic oxidation of methane (AOM), which is most likely driven by iron reduction rather than sulfate reduction.
In order to explore this ending of methanogenesis and its link to the deep AOM; in-situ profiles in the sediments as well as slurry incubation experiments in modified conditions were conducted. Profiles of dissolved organic carbon and acetate show increase in concentrations with depth, suggesting that the ending of methanogenesis is not trivial. Preliminary incubation of sediments from different depths show accumulation of acetate with depth concurrently to lower methane accumulation even with addition of acetate. Considering that the common substrates concentrations increase at this depth, the abrupt absence of methanogenesis is surprising. Different additions to the slurries suggest a link between methane, sulfur and iron at that depth that affects both methanogenesis and the deep AOM process.