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Effects of Fe(III) and organic matter additions on methanogenic activity and Fe(III) reduction in boreal lake and wetland sediments

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We studied potential methane production and Fe(III) reduction activity in lake sediments and wetland peat sampled from 14 sites in southern and eastern Finland. The concentration of total iron in the sediments and peat varied between 0.5 and 1200 ppm and their organic matter content (loss of ignition) varied between 1-98% of dry weight. Also the effects of added amorphous Fe(III) oxyhydroxide and organic matter (ammoniumacetate and/or sodiumacetate) on methanogenic and Fe(III) reduction activities were studied in anaerobic laboratory incubations (in vitro) lasting 5-20 days at 15 ºC in darkness. Potential methane production and the effects of iron and acetate additions were highly variable between lake and peatland sites. The highest methanogenic potential was generally measured in productive littoral sites, especially in those dominated by Phragmites australis vegetation stands. In these sediments the total iron concentrations were high and acetate additions clearly increased methane production whereas Fe(III) additions decreased it. Our results demonstrate that microbial Fe(III) reduction plays an important role in the anaerobic organic matter decomposition in many boreal lakes.