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Aerobic methanotrophic activity in anoxic lake sediments

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Recent observations from shallow anoxic lacustrine sediments around the world show an unexpected presence of aerobic bacterial methanotrophs, together with anaerobic microorganisms, such as methanogens and iron reducers, which may result from unverifiable traces of oxygen or some cryptic biochemical process producing oxygen. Both *mcr* gene-bearing archaea and *pmoA* gene-bearing bacterial methanotrophs were suggested to mediate methane oxidation in Lake Kinneret sediments. In these sediments, iron reduction was shown to be coupled to methane oxidation; however, with an unclear mechanism linked to methanotrophy. Here we show a new set of geochemical and microbial data from slurry experiments that tested the effect of exposure to oxygen on this aerobic and anaerobic activity. The exposure of oxygen levels up to 1% promoted aerobic methanotrophy and surprisingly increased net iron reduction in anoxic lake sediments. The iron reduction was microbially mediated and performed by either Desulfuromonas, Geobacter, or Methylomonas. The experiments allow insight into the complexity of biogeochemical cycles in anoxic lake sediments.