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The role of temperature in the interactions between methanogenesis and denitrification in a freshwater wetland sediment

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Two anerobic microbial metabolic processes, methanogenesis, the respiratory production of methane, and denitrification, the metabolic reduction of oxidized inorganic nitrogen both compete for hydrogen and small organic carbon molecules. Oxidized inorganic nitrogen also has a toxic inhibitory effect on methanogenesis. In this study, I explored the interaction of these two processes in a freshwater sediment slurry using a factorial experiment at three different temperatures (14º, 20º, and 26º C) and three nitrate amendment levels (0, 0.3, and 1.0 mmol L^{-1}) . The reduction of nitrate increased with increasing temperature, but higher temperatures inhibited methane production. High rates of denitrification produced higher concentrations of the toxic denitrification intermediates which increased the inhibitory effect of denitrification on methanogenesis. However, the fate of most of the added nitrate was reduction to ammonium or to organic nitrogen compounds, which reduced the inhibitory impact on methanogenesis. Preliminary evidence supporting the anaerobic oxidation of methane by nitrate suggested a new role for nitrate in the inhibition of methane accumulation.