pH as a control on interactions of methanogens and iron reducers

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Methanogens and iron reducers play major roles in the global carbon cycle. However, environmental controls on interactions between each are poorly known. In this study, we used semi-continuous bioreactors to examine the influence of pH on interactions between each group. The bioreactors each contained a slurry of marsh sediment amended with goethite (1 mmol). During the 91 day incubation, one set received acidic media (pH 6) while the other received media with basic pH (7.5). Media for both sets included acetate (0.25 mM) but no sulfate. We also included sets of acetate-deficient control bioreactors. The extent of iron reduction increased with decreasing pH: 21 times more iron reduction occurred at acidic pH than basic pH. In contrast, the extent of methanogenesis increased with pH: 1.6 times more methanogenesis occurred at basic than acidic pH conditions. Thus, methanogenesis increased relative to iron reduction as pH increased. Despite the lower extent of iron reduction at basic pH, the relative abundance of iron reducers decreased little relative to acidic reactors. Sequences classified with *Geobacteraceae*, a family of bacteria associated with dissimilatory metal reduction, were the largest group overall and accounted for 24 and 17% of the sequences from acidic and basic pH reactors, respectively. We account for these observations by hypothesizing that, as pH increases, interactions between iron reducers and methanogens become increasingly syntrophic.