Microbial and viral communities in wetlands support extremely high methane emissions and sulfate reduction rates

P. DALCIN MARTINS[1], S. BANSAL[2], C. T. MILLS[3], B.A. TANGEN[2], D. W. HOYT, M[4]. TFAILY[4], M. J. WILKINS[1,5]*

[1]Microbiology Department, The Ohio State University, Columbus, OH 43210, USA
[2]United States Geological Survey, Jamestown, ND 58401, USA
[3]United States Geological Survey, Denver, CO 80225, USA
[4]Environmental Molecular Sciences Laboratory, Richland, WA 99350, USA
[5]School of Earth Sciences, The Ohio State University, Columbus, OH 43210, USA (*correspondence: wilkins.231@osu.edu)

Introduction

The Prairie Pothole Region (PPR) of North America is the tenth largest wetland ecosystem in the world [1] and contains millions of small weltands that are very rich in dissolved organic carbon (DOC) and sulfur-containing compounds [2]. Given that inland waters have been increasingly recognized as critical sites of methane emissions [3], this study investigated methane production and emissions from PPR wetlands with an emphasis on linked carbon and sulfur cycles using a suite of geomicrobiological tools [2].

Discussion of Results

Depth-resolved sediment samples were collected in winter, spring and summer of 2015 from two wetlands in North Dakota, P7 and P8. Sulfate reduction rates were the highest ever measured in terrestrial aquatic environments and increased from winter to summer, particularly at 10-12 cm depths, which corresponded to increases in the "biodegradability" of DOC. Methane concentrations in pore waters reached a peak of ~ 6 mM over spring that persisted throught late summer. Methane emissions were among the highest ever recorded and followed similar trends, reaching more than 100 mg CH_4/m^2/hour. Microbial communities were strongly controlled by geochemical factors and differed by wetland, while viral populations correlated to microbial communities. In conclusion, our data indicated that the PPR is a poorly recognized but important region for methane emissions, and a hotsopt for microbial and viral activity.

[1] Keddy *et al*. (2009) *BioScience* **59**, 39-51. [2] Dalcin Martins *et al*. (2017) *Global Change Biology*. [3] Holgerson & Raymond (2016) *Nature Geosciences* **9**, 222-226.