Drivers of Methanogenesis Pathways in Subtropical Wetlands: Florida Everglades as a Case Study

Ngatia, L[1]; Hinz, F.[1]; Normand A.E.[1]; Inglett, P.[1]; Chanton, J.[2]; Inglett, K.S.[1]; Reddy, K.R.[1]; *([1]University of Florida, Department of Soil and Water Science; [2]FSU Department of Oceanography)*

Introduction - Methanogenesis is an important process in the wetlands that influences global warming Ye et al. 2014. In the Florida Everglades the dominant methanogenesis pathways include hydrogenotrophic and acetoclastic, which vary spatially. However, the drivers of the two pathways are not clear. Our objective was to determine the effects of organic matter quality on methanogenesis pathways. We hypothesized that recalcitrant carbon favored hydrogenotrophic pathway but not acetoclastic pathways.

.

Experimental – Soil samples were collected from Florida Everglades WCA-2A. We used biogeochemical properties and solid-state ^{13}C-CPMAS-NMR using Avance III 500 MHz at McKnight Brain Institute, University of Florida to determine the organic matter quality. Methane and carbon dioxide production were measured from WBL laboratory at University of Florida.

Results and Discussion

There was increasing alkyl C, alkyl:O-alkyl ratio and decreasing O-alkyl ratio with increasing soil depths indicating an organic matter decomposition gradient from the upper depths to deep depths. Both CH_4 and CO_2 decreased with increasing depth. Alkyl:o-alkyl ratio had a negative relationship with acetoclastic methanogenesis Fig.1. Alkyl C had a significantly negative relationship with acetoclastic methanogenesis but not significantly so for hydrogenotrophic methanogenesis (Fig. 2).

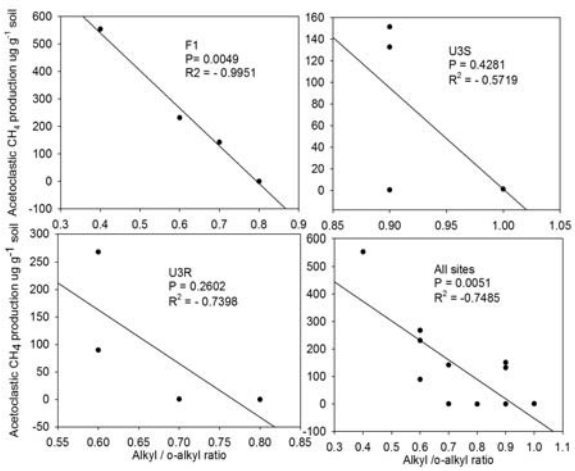

Fig.1 Relationship between alkyl:o- alkyl ratio and acetoclastic methanogenesis

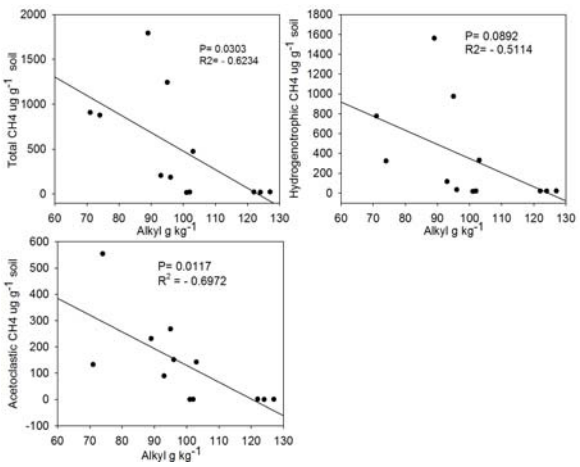

Fig. 2: Relationship between alkyl C and methanogenesis

Conclusions

Organic matter recalcitrance appears to facilitate hydrogenotrophic pathway over acetoclastic pathway. Changes in organic matter quality will shift the dominant methanogenesis pathways and influence CH_4 production.

Acknowledgements

A portion of this work was performed at the National High Magnetic Field Laboratory, which is supported by National Science Foundation Cooperative Agreement No. DMR-1157490, the State of Florida, and the U.S. Department of Energy.

In addition, this work was funded by National Science Foundation grant #DEB-0841596.

References

Ye R., et al., Soil Biology & Biochemistry, **68**,385–391 (2014).