Interpretation of depth profiles of organic sulfur species in northern Peatlands

OLHA FURMAN1, BRANDY M. TONER1, EDWARD A. NATER1, STEPHEN D. SEBESTYEN2 AND RANDALL K. KOLKA2

1Department of Soil, Water, and Climate, University of Minnesota, St. Paul, MN 55108 (*correspondence: Olga.Furman@canberra.edu.au, brandy.toner@gmail.com)
2USDA Forest Service, Northern Research Station, Grand Rapids, MN 55744
3Current affiliation: Institute for Applied Ecology, University of Canberra, ACT 2601, Australia

Microbial processing of sulfur (S) is of high interest in peatland systems due to established linkages between mercury, carbon and S cycles through sulfate reduction processes [1]. Sulfate reduction may occur at different spatiotemporal scales in response to short-term and long-term water table fluctuations in low S environments. Budgets of major S pools were quantified at the S-1 bog in northern Minnesota by using synchrotron based S 1s X-ray absorption near-edge spectroscopy. S accumulation rates (0.22-1.19 g m⁻² y⁻¹) have shown significant within-bog spatial variability, however, similar biogeochemical controls govern S species distribution in the subsurface at the S-1 bog. Reduced organic S species comprised 71-84% of total S and the relative contribution of reduced S species increased with depth. Results suggest that organic disulfides undergo high S turnover and appear to be the most biologically dynamic and reactive pool in surface soils. The co-location of methyl mercury (MeHg) and organic disulfide maxima in the subsurface of peat profiles suggests that sulfate reduction processes may be associated with high retention of organic disulfide and MeHg in the subsurface. Both indicators are predicted to be sensitive to changes in climate variables.