Control of Sphagnum-Derived Dissolved Organic Matter on Methane Production in Peatland Soils

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Peatlands are important ecosystems in the global carbon cycle serving as the largest terrestrial soil carbon pool and a significant source of the greenhouse gas CH4. In Sphagnum-dominated wetlands, production of CH4 is variable and controlling factors are poorly understood. Our objective was to determine if Sphagnum chemistry controlled CH4 production across three Sphagnum-dominated soils with variable CH4 production.

Soils were incubated anaerobically for 40 days with Sphagnum-derived dissolved organic matter (S-DOM) extracted with water at 25 or 60°C in a fully-crossed experimental design, and monitored for CO₂, CH4, DOC, and phenolic concentrations. Hot extracts contained greater DOC and phenolics relative to cold extracts and stimulated CO₂ production in all soils. One soil produced no CH4 during the incubation, regardless of S-DOM addition. However, site-specific inhibition or stimulation of CH4 production was observed following S-DOM addition in remaining soils. High CO₂:CH4 in hot extract amended soil suggests S-DOM was available to microbes, but not utilized by methanogens. These data suggest Sphagnum chemistry alone does not explain low CH4 production, but can be a controlling factor in some peatlands.