Geophysical Research Abstracts
Vol. 16, EGU2014-6660, 2014
EGU General Assembly 2014


# Phylogenetic or environmental control on the organo-chemical composition of Sphagnum mosses?

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Decomposition of organic material is one of the key processes that determines the size of the soil-feedback to global warming, but it is also a process surrounded with one of the largest uncertainties, making understanding its mechanistic drivers of crucial importance. In organic soils decomposition is closely determined by the organo-chemical composition of the litter entering the soil. But what, in turn drives the organo-chemical composition? Is it an emergent feature of the environment the species producing the litter grow in, or is it an evolutionary trait that can be tracked through the species' phylogeny?

We set out to answer this question for one of the most import peat-forming plants on earth: the genus Sphagnum. We sampled 18 Sphagnum species, about equally distributed over 6 sites spanning a wide range of environmental conditions: most species were collected at multiple sites. For all species we characterised the chemical composition, focussing on three functional chemistry groups: (i) mineral elements, (ii) carbohydrate polymers (iii) non-carbohydrate polymers (aromatic and aliphatic compounds) . For each group of compounds we used multivariate statistical techniques to derive the degree of variation explained by environment: (site, position within site) and phylogeny (sections within genus Sphagnum).

We found that the variation in mineral element concentrations was mostly explained by environment, with the biggest differences in the concentrations of basic cat-ions calcium and magnesium. In contrast, the variation in carbohydrates was mostly explained by phylogeny, with clear associations between sections and monosaccharides. The monosaccharide rhamnose was associated with species from the Acutifolia section known for their poor degradability, whereas xylose and galactose were closely associated with degradable species from the Cuspidata section. The composition non-carbohydrate polymers took an intermediate position: both environment and phylogeny explained a significant part of the variation.

We conclude that organo-chemical composition a function of both environment and phylogeny, but that the relative importance of these drivers depends on the type of compounds studied. Environment mainly drives the mineral element composition and a large part of the non-carbohydrate polymer composition, whereas phylogeny drives the variation in carbohydrate polymers. In our presentation we discuss the implications of our findings for carbon accumulation in peatlands and decomposition processes in general.