Molecular tools for understanding biomarker compounds

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Hopanoids are pentacyclic triterpenoids found in some bacteria and widely used as organic geochemical proxies. A confident interpretation of this record requires an understanding of the function and distribution of these compounds among bacterial taxa. Recent analytical developments allowing the rapid identification of hopanoid structures [1] have made large strides towards this end. We complement this approach by performing three types of experiments: i) genetic experiments in a model organism (*Methylobacterium*) to identify genes involved in the synthesis of hopanoid side chains; ii) physiological experiments to understand the function of hopanoids, iii) replicate experimental evolution in the laboratory to understand how an organism might acquire adaptations to compensate for the absence of hopanoids.

Our studies have yielded results that have consquences for geochemical interpretation. By constructing genetic mutants, we have found that adenosylhopane is an intermediate in the synthesis of composite hopanoids in *Methylobacterium*, and this likely holds in all hopanoid-producing bacteria. This compound has previously been interpreted as a marker of terrestrial input to marine sediments [2], and this can be evaluated in light of our new understanding.

We have also found that the disruption of genes involved in hopanoid biosynthesis in *Methylobacterium* causes growth defects. The growth defect is particularly severe in a strain of *Methylobacterium* in which we disrupted hopanoid synthesis Experimental evolution of this strain in the laboratory has allowed this strain to overcome some of this defect. Other mutants, which can make hopanoid backbones but lack the ability to make either composite hopanoids or A-ring methylated hopanoids, have less-severe but still detectable growth defects. Examination of these phenotypes may cast light on the function of these molecules, which can be used to interpret the geochemical record.

[1] Talbot, Rohmer & Farrimond (2007), *Rapid Comm. Mass. Spec.* **21**: 1-13. [2] Cooke, Talbot & Wagner (2008), *Org. Geochem.* **39**:965-971

Effect of different vegetation cover on throughfall chemistry

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The monitoring of throughfall at the forest ground is a widely accepted approach for the estimation of trace-substance input in different forest types and in different regions [1, 2]. This study is focused on the evaluation of quantity of materials incoming into forest soil affected by acidification process under spruce forest (*Picea abies (L.) Karst)* and under beech forest (*Fagus sylvatica L.),* and describing the fluctuation of elements in precipitation within the monitoring period. Precipitation samples were collected at monthly intervals from April to October during the years 2008 - 2010 in the Jizera Mountains. Precipitation samples were quantified and analyzed for selected components (NO_3^-, SO_4^{2-}, Cl^-, F^-) and total amount of Na, Ca, K, and Mg. pH and conductivity of precipitation were measured. Statistical analyses like simple and multiple regression and correlation and multifactorial analysis of variance were used. Results of this work showed the elements, which flow into the soil under beech forest and under spruce forest, their preference transport way and amount of them.

[1] Likens & Bormann (1995) *Biogeochemistry of a forest ecosystem*. 159 p. 2nd ed. Springer-Verlag, New York. [2] Puhe & Ulrich (2001) *Global Climate Change and Human Impacts on Forest Ecosystems*. Springer-Verlag, Berlin.