WasserCluster Lunz & University of Natural Resources and Life Sciences, Vienna
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Master thesis

The Effect of Phytoplankton Exudates on Shale Rock organic matter degradation

Background

This study is a part of a broader project "ECATA" (funded by FWF), which aims at investigating the role of extreme events (i.e., typhoon-triggered landslides) in the carbon dynamics along a terrestrial-aquatic continuum. Extreme events affect terrestrial ecosystem by resetting soil formation and vegetation succession, and transport terrigenous OC (TerrOC) of various sources, age and chemical composition into fluvial systems. TerrOC become exposed to new physical and biochemical reactions associated to microbial processing. The goal of this study is to quantify the response of microbial communities and their capacity to degrade OC pools of distinct terrestrial origins. It is a crucial step to start understanding the ecosystem-scale effects of typhoons and landslides on aquatic environments.

Research question:

Will the heterotrophic bacterial degradation on old-aged shale rock compared to other terrestrial sources be influenced by the presence of labile phytoplankton exudates?

Approach:

Shale rock POM and shale rock leachate will be incubated with Lunzer lake water (or river water) in temperature/ humidity controlled climate chamber. In addition, a set of ^{13}C-spiked phytoplankton exudates will be added in the middle of the experiment to mimic priming effect.
DOM and nutrients will be first analysed for its quality and quantity in the beginning of the experiment and monitored. Microbial activity analysis including respiration rate, bacterial direct counts, extracellular enzymatic activity and bacterial secondary production will be conducted in defined time intervals throughout a 30-day incubation. In the beginning, middle and after incubation, further specific analyses will be performed including stable isotopes.

Location: WasserCluster Lunz, Lunz/See

Start: Summer 2015

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AG Bioframes -Biogeochemical Functions: Research And Management in Ecosystems at multiple Scales

Master thesis

The dissolved organic carbon (DOC) sorption and desorption capacity of shale rock and other terrestrial sources

Research background:
Typhoon-induced landslides transport huge amount of rock and soil material into aquatic system in the tropics every year. However, besides the biological importance, the physical mechanism of how these fine terrestrial material interact with aquatic/terrigenous dissolved organic carbon is not yet fully understood. Sorption behaviour of minerals provides an important gateway for storing DOC on surfaces of fine particles, which might influence the DOC burial and tendency of microbial degradation despite the OC content in rocks is low. The thesis is part of the FWF project ECATA.

Research question:
To what extent does the aquatic/terrigenous DOC adsorb onto the surface of ground shale rock particles and is an equilibrium reached over time?

Approach:
Batch sorption experiments (BSE) of 2 kinds, equilibrium and kinetic, will be conducted based on Remington et al. (2007). B-horizon soil developed on shale rock and ground shale rock will be used as 2 kinds of POM; freshwater phytoplankton exudates and bamboo litter derived leachate will be 2 different kinds of DOC stock solution, which the concentration is then adjusted with artificial inorganic solution into 5 gradient steps (for equilibrium BSE). In total, 4 treatments along with a control (only artificial inorganic solution) will be conducted.
For equilibrium BSE (linear model), DOC of 2 sources with 5 gradients steps will be used. Initial and the final DOC concentration will be measured, total experiment time is 24 hrs.
For kinetic BSE, experiment will be stopped at multiple time steps (10 at least) within a 48-hr time span for retrieving a best fit curve (power function). Both 2 kinds of DOC sources but only 1 concentration step will be conducted.

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2. Kothawala, D. N. et al. 2008. Adsorption of dissolved organic carbon to mineral soils: A comparison of four isotherm approaches. Geoderma 148: 43–50.