Geophysical Research Abstracts
Vol. 16, EGU2014-15962, 2014
EGU General Assembly 2014

The impact of elevated CO_2 concentrations on soil microbial community, soil organic matter storage and nutrient cycling at a natural CO_2 vent in NW Bohemia

Martin Nowak (1), Felix Beulig (2), Joe von Fischer (3), Jan Muhr (1), Kirsten Kuesel (1), and Susan Trumbore (1)

(1) Max Planck Institute for Biogeochemistry, Hans-Knoell Strasse 10, 07745 Jena, Germany (mnowak@bgc-jena.mpg.de), (2) Aquatic Geomicrobiology Group, Institute of Ecology, Friedrich Schiller University Jena, Dornburger Str. 159, 07743 Jena, Germany, (3) Department of Biology, Colorado State University, Fort Collins, CO 80523

Natural CO_2 vents or "mofettes" are diffusive or advective exhalations of geogenic CO_2 from soils. These structures occur at several places worldwide and in most cases they are linked to volcanic activity. Characteristic for mofette soils are high CO_2 concentrations of up to more than 90% as well as a lack of oxygen, low pH values and reducing conditions.

Mofette soils usually are considered to be sites of carbon accumulation, which is not only due to the absence of oxygen, but might also result from lower plant litter quality due to CO_2 fertilization of CO_2 influenced plants and reduced availability of N and P for the decomposer community.

Furthermore, fermentation processes and the formation of reduced elements by anoxic decomposition might fuel chemo-lithoautotrophic or mixotrophic microbial CO_2 uptake, a process which might have important ecological functions by closing internal element cycles, formation of trace gasses as well as by re-cycling and storing of carbon. Several studies of microbial community structure revealed a shift towards CO_2 utilizing prokaryotes in moffete soils compared to a reference site.

Here, we use combined stable and radiocarbon isotope data from mofette soils in NW Bohemia to quantify the contribution of geogenic CO_2 to soil organic carbon formation within mofette soils, either resulting from plant litter or from microbial CO_2 uptake. This is possible because the geogenic CO_2 has a distinct isotopic signature (δ^{13}C = -2 ‰ Δ^{14}C = -1000 ‰) that is very different from the isotopic signature of atmospheric CO_2. First results show that mofette soils have a high C_{org} content (20 to 40 %) compared to a reference site (2 to 20 %) and soil organic matter is enriched in ^{13}C as well as depleted in ^{14}C. This indicates that geogenic CO_2 is re-fixed and stored as SOM.

In order to quantify microbial contribution to CO_2 fixation and SOM storage, microbial CO_2 uptake rates were determined by incubating mofette soils with $^{13}CO_2$ labelled gas.

The findings of this study can help to understand interactions of soil, microorganisms and plants under elevated CO_2 concentrations in these special soils. Further, they will help to quantify the process of autotrophic uptake of CO_2 in soils and its influence on subsurface C cycling.