THE IMPACT OF THE MILIEU ON ORGANIC MATTER DECAY IN A REWETTED EUTROPHIC PEATLAND: A STUDY ON CHANGES IN LIGNIN COMPOSITON.

J. Gensel[1, 2], D. Zak[1, 3], H. Reuter[1]

[1] Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Berlin, Germany
[2] Humboldt-Universität zu Berlin, Berlin, Germany
[3] Aarhus University, Silkeborg, Denmark

Rewetting degraded peatlands for recovering carbon accumulation is often accompanied with the formation of shallow lakes (Zak et al., 2010). Those systems are mainly characterized by high emission of greenhouse gases like CO_2 and CH_4, high concentrations of dissolved nutrients and DOC owing to the highly decomposed peat as a tremendous source (Zak et al., 2015; Hahn-Schöfl, 2011). In fact, little information is available about the unexpected high organic matter decay and carbon fluxes but a former experiment indicated that the high biomass production of submerged hydrophytes instead of revegetation with typical peat forming plants promotes microbial decomposition in rewetted peatlands.

By observing lignin oxidation products (LOPs), the decomposition of senescent plant litter can be monitored and even changing terrestrial vegetation can be identified. Our new approach is the determination of these LOPs over the different vertical depth zones representing milieus with strongly contrasting chemical characteristics, i.e. the open waterbody of the shallow lake, the emerging limnic sediment, consisting of the remains of the decomposing hydrophyte vegetation, and the underlying layer of nutrient enriched highly degraded peat.

Our study site is an iron-rich, methanogenic degraded fen (Zarnekow, Dargun, Mecklenburg-Western Pomerania, NE Germany). To stop aerobic peat decomposition and to re-establish peat growth as long-term carbon sink the site was rewetted 10 years ago. Still there is a gap of knowledge how organic matter decay is functioning in such newly formed systems. Therefore, dialysis samplers with 50 mL chambers separated from the environment using 0.2 μm polysulfon membrane (Pall Corporation, USA) were buried for 16 months and *Phragmites australis* leaves were incorporated into every second cavity with special emphasis on the milieu-dependent transformation of lignin.

In order to determine low concentrations of LOPs in aqueous phases we modified an alkaline CuO oxidation procedure followed by GC-tandem MS analysis (Kaiser & Benner, 2012). In addition, we run analysis of lignin in the decomposed leaves and a portrayal of the extent of their decomposition via FTIR.

Preliminary results show a clear increase of dissolved lignin within increasing soil depth (Fig. 1). As DOM exchange with the environment is not hindered in the experimental setup, this results indicates the constant release of dissolved lignin from the decomposing leaf litter even after 16 month of the start of this decomposition experiment. There is also some evidence that the milieu characteristics determined the type and quantity of specific lignin phenols which are released.

Further data evaluation will be performed in order to specify the factors controlling the composition of the labile dissolved lignin pool and the lignin transformations in the leaf litter.

On this basis we should get a better understanding on organic matter decay in rewetted peatlands.

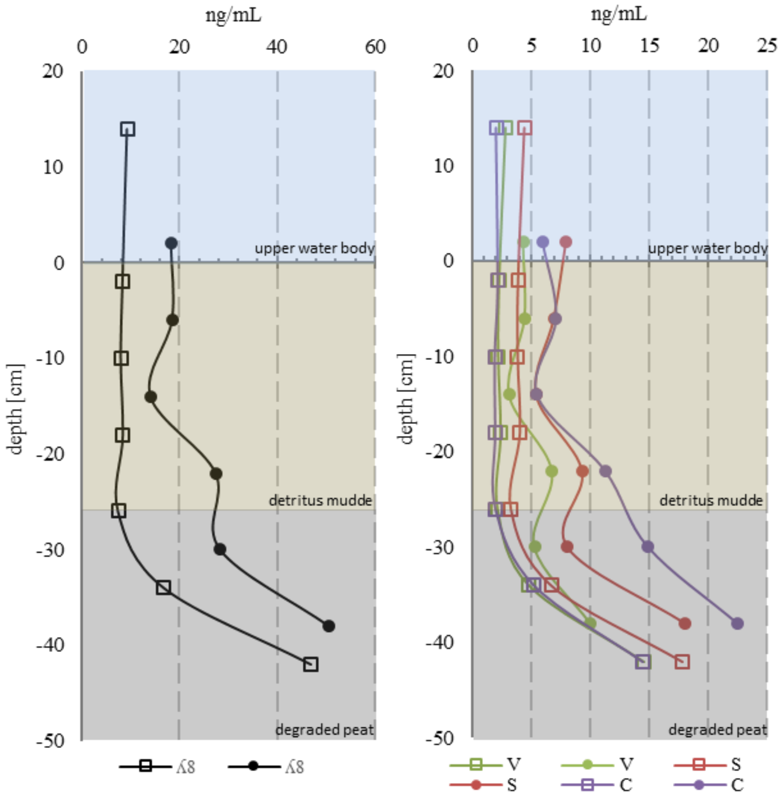

Figure 1 Vertical profile of lignin sum parameters in the aqueous phase of upper water body and underlain soil layers.
●: leaf containing chambers, □: no leaf containing chambers.
λ8: ∑8 lignin phenols of vanillyl, syringyl and cinnamyl phenols, V: ∑3 lignin phenols of vanillyl phenols, S: ∑3 lignin phenols of syringyl phenols, C: ∑3 lignin phenols of cinnamyl phenols.

References

Hahn-Schöfl, M. et al., 2011. Organic sediment formed during inundation of a degraded fen grassland emits large fluxes of CH4 and CO2. Biogeosciences 8, 1539-1550.

Kaiser, K., Benner, R., 2012. Characterization of Lignin by Gas Chromatography and Mass Spectrometry Using a Simplified CuO Oxidation Method**.** Analytical Chemistry 84, 459-464.

Laiho, R., 2006. Decomposition in peatlands: Reconciling seemingly contrasting results on the impacts of lowered water levels. Soil Biology and Biochemistry 38, 2011-2024.

Zak, D., Reuter, H., Augustin, J., Shatwell, T., Barth, M., Gelbrecht, J., McInnes, R.J., 2015. Changes of the CO_2 and CH_4 production potential of rewetted fens in the perspective of temporal vegetation shifts. Biogeosciences 12, 2455-2468.

Zak, D., Wagner, C., Payer, B., Augustin, J. and Gelbrecht, J., 2010. Phosphorus mobilization in rewetted fens: the effect of altered peat properties and implications for their restoration. Ecological Applications 20, 1336–1349.