

## **Biomarker analysis is used in reading soil archives, but do biomarkers survive processes as leaching and digestion?**

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In previous studies (1,2) we showed that biomarker analysis, i.e. the use of preserved molecular fingerprints indicative of e.g. past vegetation cover or soil organic matter input, is a useful additional technique to read the soils archives in combination with palynology and absolute dating techniques. In these studies we compared biomarker spectra with fossil pollen spectra, using the premise that biomarkers are always released from onsite decomposing plant species and pollen can originate from onsite as well as offsite species. However, compared with pollen analysis, biomarker analysis is a juvenile technique and before it can grow into an established method, some fundamental questions must be answered.

In the study of palaeo-Podzols (1) we used firstly pollen spectra to indicate the broad suite of plant species involved in the dynamics of drift sand landscapes. Secondly, we used biomarker spectra to separate onsite from offsite plant species, in order to select the species responsible for landscape stabilization and soil organic carbon sequestration. In this study we interpreted pollen and biomarker spectra from (buried) humic horizons, but we did not explicitly address the sensitivity of biomarkers for possible selective corrosion by soil processes as leaching and transport. Therefore, we analyzed (pollen as well as biomarkers) of samples from the Ah and Bh horizon of (buried) Podzols to investigate the sensitivity of biomarkers for soil processes as podzolization.

In the study of plaggic Anthrosols (2) we used biomarkers to indicate stable fillings used to produce plaggic manure. Pollen of *Calluna* was observed in all the spectra of the plaggic horizon, biomarkers of *Calluna* only in the youngest spectrum. Consequently, we concluded that only in the last phase of the development of the plaggic horizon the farmers applied sods of the *Calluna* heath.

However, sheep grazing occurred at least since the early Middle Ages and that means that sheep droppings were always part of the plaggic manure. The favorite food consists of grasses, but at the end of the season when grasses become scarce, the animals also consume *Calluna* shoots. The fact that we did not find any *Calluna* markers in the older samples may indicate that the biomarkers cannot survive animal congestion. Therefore, we analyzed sheep droppings, collected during the seasons of one year (pollen as well as biomarkers) to investigate the sensitivity of biomarkers for digestion by sheep.

The results of these experiment will be presented on the EGU Soil-SRP session, April 2017, Vienna.

1) J.M. van Mourik, and B. Jansen (2013). The added value of biomarker analysis in palaeopedology; reconstruction of the vegetation during stable periods in a polycyclic driftsand sequence in SE-Netherlands, *Quaternary International*, 306, 14–23, 2013.

2) J.M. van Mourik, T.V. Wagner, J. G. de Boer and B. Jansen (2016). The added value of biomarker analysis to the genesis of plaggic Anthrosols; the identification of stable fillings used for the production of plaggic manure. *SOIL*, 2, 299–310, 2016.