



Biomarker in archaeological soils

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The use of biomarkers in an archaeological context allow deeper insights into the understanding of anthropogenic (dark) earth formation and from an archaeological point of view, a completely new perspective on cultivation practices in the historic past.

During an archaeological excavation of a Slavic settlement (10th/11th C. A.D.) in Brünkendorf (Wendland region in Northern Germany), a thick black soil (Nordic Dark Earth) was discovered that resembled the famous terra preta phenomenon. For the humid tropics, terra preta could act as model for sustainable agricultural practices and as example for long-term CO₂-sequestration into terrestrial ecosystems. The question was whether this Nordic Dark Earth had similar properties and genesis as the famous Amazonian Dark Earth in order to find a model for sustainable agricultural practices and long term CO₂-sequestration in temperate zones. For this purpose, a multi-analytical approach was used to characterize the sandy-textured Nordic Dark Earth in comparison to less anthropogenically influenced soils in the adjacent area in respect of ecological conditions (e.g. amino sugar), input materials (faeces) and the presence of stable soil organic matter (black carbon).

Amino sugar analyses showed that Nordic Dark Earth contained higher amounts of microbial residues being dominated by soil fungi. Faecal biomarkers such as stanols and bile acids indicated animal manure from omnivores and herbivores but also human excrements. Black carbon content of about 30 Mg ha⁻¹ in the Nordic Dark Earth was about four times higher compared to the adjacent soil and in the same order of magnitude compared to terra preta. Our data strongly suggest parallels to anthropogenic soil formation in Amazonia and in Europe by input of organic wastes, faecal material and charred organic matter. An obvious difference was that in terra preta input of human-derived faecal material dominated while in NDE human-derived faecal material played only a minor role. The majority of the faecal residues in the NDE derived from pigs, cows and sheep. A precise statement about animal derived faecal in terra preta is not possible due to limited data of steroid composition of Amazonian animals. Nevertheless, the existence of this terra preta-like soil in the temperate zone in Europe is an excellent example for the existence of anthropogenic dark earth beyond the humid tropics with favorable properties.