



Storage of natural soil organic matter on Fe oxides and clay minerals

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Interactions of organic matter with mineral surfaces is seen as one of the important mechanisms to increase carbon preservation in soils. What fraction of the soil organic matter is able to adsorb to different surfaces and the surface coverage under different conditions is still a matter of debate.

We used SEM-EDX, X-ray fluorescence imaging, and X-ray absorption spectromicroscopy (STXM-NEXFAS) at the C1s absorption edge to quantify extent and chemical composition of organic coatings on natural Fe oxides and clay minerals from a Podzol Bs and a Gley Bg horizon. For these subsoils we assumed that organic coatings develop by adsorption from dissolved organic matter of the soil solution. We compared these samples with synthetic goethites, that had been in contact with biofilms and with Fe oxides and clay minerals from surface water flocs of a spring, i.e. to samples for which we assume that most of the organic matter is microbially derived.

The organic coatings on goethites from the biofilm-sample were dominated by proteins and alkyl C. In comparison, the organic matter on Fe oxides from the spring were clearly enriched in aryl C and O-alkyl C, but depleted in alkyl C. Coatings on Fe oxides from the Gleysol and the Podzol were rich in alkyl C and carbonyl C.

Mineral surfaces from the Podzol Bs horizon were fully coated by organic matter, whereas in the Gley Bg horizon and in the surface water flocs organic matter was mainly found on Fe oxides. However, the C concentration on the Fe oxides varied and some Fe oxides appeared to be free of organic matter. Clay minerals of the Gley Bg horizon and the spring sample were either free of organic matter or showed a lower concentration of organic matter than the Fe oxides.

Our observations are in accordance with the high reactivity of Fe oxides towards organic matter sorption. However, only the minerals of the Podzol Bs horizon were fully coated, i.e. saturated with organic matter. Even when found in close proximity to bacterial cells, like in the spring samples, the Fe oxide associated organic matter had a strong contribution of OM of non-microbial origin.